California High-Speed Train Program EIR/EIS

TASK 2.3.1R

LOS ANGELES TO SAN DIEGO VIA ORANGE COUNTY
High-Speed Train Alignments/Stations Screening Evaluation

REVISED DRAFT

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ACRONYMS

Authority	California High Speed Rail Authority
BNSF	Burlington Northern Santa Fe Railway
Caltrans	California Department of Transportation
CDFG	California Department of Fish and Game
CEM	Crash Energy Management
CEQA	California Environmental Quality Act
CTA	Central Terminal Area (LAX)
DOT	Department of Transportation
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
FAA	Federal Aviation Administration
FRA	Federal Railroad Administration
GIS	Geographic Information Services
HOV	High Occupancy Vehicle
HS	High Speed [Train]
I-#	Interstate #
ICE	InterCity Express (Germany)
ITC	Irvine Transportation Center
JPA	Joint Powers Authority
Km/h	Kilometers per hour
LA	Los Angeles
LADOT	Los Angeles Department of Transportation (City of Los Angeles)
LAWA	Los Angeles World Airports
LAX	Los Angeles International Airport
LOSSAN	Los Angeles to San Diego
LRT	Light Rail Transit
Maglev	Magnetic Levitation
MAP	Million Annual Passengers
MCAS	United States Marine Corps Air Station
MOS	Minimum Operating Segment
Mph	Miles per hour
MTA	Los Angeles County Metropolitan Transportation Authority
MTDB	Metropolitan Transportation Development Board (San Diego County)
NCTD	North County Transit District (San Diego County)
NEPA	National Environmental Policy Act
NRCS	United States Natural Resources Conservation Service
OC	Orange County
OCTA	Orange County Transportation Authority
OTC	Oceanside Transportation Center
PE	Pacific Electric Railroad
ROW	Right-of-Way

RTP	Regional Transportation Plan
SARC	Santa Ana River Channel
SANDAG	San Diego Association of Governments
SCAG	Southern California Association of Governments
SCR	Senate Concurrent Resolution
SCRRA	Southern California Regional Rail Authority (Metrolink)
SDNR	San Diego Northern Railway
SR-#	State Route #
UCI	University of California, Irvine
UCSD	University of California, San Diego
UP	Union Pacific Railroad
USFWS	United States Fish and Wildlife Services
UTC	University Towne Centre
VHS	Very High Speed [Train]

S.0 SUMMARY

Following adoption of a *Final Business Plan*[1] in 2000, the California High-Speed Rail Authority (Authority) recommended the state proceed with implementation of a statewide high-speed train system by initiating the formal state and federal environmental review process through the preparation of a state program-level Environmental Impact Report (EIR) and a federal Tier I Environmental Impact Statement (EIS) or Program EIR/EIS. The Authority is the state lead agency for the California Environmental Quality Act (CEQA) and the Federal Railroad Administration (FRA) is the federal lead agency for the National Environmental Policy Act (NEPA). As part of the Program EIR/EIS, a number of project alternatives will be evaluated including a High-Speed Train Alternative. Within the High-Speed Train Alternative, there is a range of high-speed train alignment and station location options to be considered.

The purpose of this High-Speed Train Alignments/Stations Screening Evaluation is to consider all reasonable and practical options within the Los Angeles-Orange County-San Diego corridor at a consistent level of analysis and focus the Program EIR/EIS on those alignment and station options that best attain the following objectives established by the Authority:

- Maximize Ridership/Revenue Potential
- Maximize Connectivity and Accessibility
- Minimize Operating and Capital Costs
- Maximize Compatibility with Existing and Planned Development
- Minimize Impacts to Natural Resources
- Minimize Impacts to Social and Economic Resources
- Minimize Impacts to Cultural Resources
- Maximize Avoidance of Areas with Geological and Soils Constraints
- Maximize Avoidance of Areas with Potential Hazardous Materials

This alignment and station screening evaluation was accomplished through the following key activities:

- Confirmation/reconsideration of past alignment and station decisions based on review of previous studies.
- Identification of alignment and station options not previously evaluated through meetings with elected officials and public agencies and through the environmental scoping process.
- Evaluation of alignment and station options using standard engineering, environmental, and financial criteria and evaluation methodologies.
- Identification of the alignment and station options' ability to attain defined objectives.

S.1 ALIGNMENT AND STATION OPTIONS STUDIED

Of the five corridors being studied by the Authority, the Los Angeles – Orange County – San Diego corridor is unique in that it contains, from end to end, an existing intercity passenger rail corridor – the Los Angeles to San Diego (LOSSAN) corridor. In terms of passenger volumes, the LOSSAN corridor is Amtrak's second-busiest corridor in the nation, after the Northeast Corridor connecting Washington, D.C. to New York City. It is used by Amtrak for the State-supported Pacific Surfliner Service between Los Angeles and San Diego, by the Southern California Regional Rail Authority for its Metrolink commuter rail service in Los Angeles and Orange Counties, and in San Diego County by the North County Transit District for its Coaster commuter rail service. Burlington Northern Santa Fe also uses the corridor for freight service.

[1] California High-Speed Rail Authority. *Building a High-Speed Train System for California, Final Business Plan*. June 2000.

The presence of the LOSSAN corridor provides an excellent opportunity, as it raises the possibility of building a high-speed train system by incrementally improving an existing service, including the possibility of using conventional fossil-fuel trains rather than electrically powered steel-wheel-on-steel-rail or Maglev technologies. Therefore, in addition to considering alignment options, this study examines two levels of incremental improvements to the LOSSAN corridor that would support different levels of high-speed service, as alternative high-speed train "build" options.

However, the corridor also poses some considerable constraints. It passes through one of the most densely populated areas of the State and, in southern Orange County and San Diego County, traverses ecologically sensitive coastal areas. Due to these significant environmental and community constraints, the LOSSAN options would not be dedicated services. The options either require high-speed trains to share tracks with existing Amtrak, commuter rail and freight service, or would be a separate "feeder" service that would require a transfer to the rest of the high-speed network, at LA Union Station or in Orange County.

As studied in this report, the range of LOSSAN options are bracketed by the following two representative configurations:

1. LOSSAN Configuration A - Upgrade the existing LOSSAN corridor with full double-tracking and partial grade-separation to allow rail services to operate at up to 125 mph (200 km/h). All existing Amtrak stations would continue to be served by both existing and high-speed trains. This option assumes a conventional fossil-fuel train system that would not be compatible with the rest of the statewide network. This would require passengers to transfer to and from the rest of the statewide train system at LA Union Station in Los Angeles. Within this screening evaluation, this configuration is represented by alignment options B1a, C1a, and D1a.

2. LOSSAN Configuration B - Upgrade the LOSSAN corridor to full high-speed train standards, including complete grade separation, to permit rail services to travel over 125 mph (200 km/h) in some areas, and allow through-running of trains from other parts of the statewide system. High-speed trains would serve only designated stations, with bypass tracks provided where feasible at all stations including existing Amtrak and commuter rail stations to facilitate express operations. Due to the existing geometry of the LOSSAN corridor, and requirement for shared-use, speeds will not be as high as proposed for other segments of the statewide network. This configuration includes alignment options B1b, C1b, and D1b, and represents the highest level of capital improvements studied for an electrified, fully grade-separated system. The physical upgrades embodied in this option can occur with or without electrification. Without electrification, the "b" option encompasses the highest level of capital improvements studied with a conventional fossil-fueled system.

For the sake of simplicity the LOSSAN "a" and "b" options are discussed throughout this report as two distinct options. However, they should be seen as two bookends in what is in fact a continuous spectrum of design options. By drawing selectively from different elements of "a" and "b" in different parts of the corridor, it would be possible to configure a large number of distinct options between the two extremes discussed in this report.

The set of LOSSAN improvements proposed in the Amtrak 20-Year Plan[2] and in the Authority's *Final Business Plan* also fall within the range of the "a" and "b" options. Generally, the Amtrak plan is more closely related to the "a" option, while the Business Plan improvements are closer to the "b" option, but each represents a different mix of elements from both the "a" and "b" options.

[2] Parsons Brinckerhoff. *California Passenger Rail System 20-Year Improvement Plan*. Prepared for Amtrak, March 2001.

Beyond upgrading the LOSSAN corridor, this study also examines a set of alignments within dedicated rights-of-way for the Los Angeles to San Diego coastal corridor. In addition, several alignments are studied to see if a high-speed connection between Los Angeles International Airport (LAX) and LA Union Station would be feasible. These dedicated alignments would be fully compatible with the rest of the statewide system.

Figure S-1 shows the alignment and station options within this corridor. In all, the options encompass a system from Los Angeles to San Diego via Orange County that would be about 117 to 123 miles (189-198 km) long, and could potentially carry passengers between the two points in 72 to 78 minutes.

The Los Angeles-Orange County-San Diego corridor was divided into four segments for analysis purposes. The endpoints of the segments are the stations closest to the points where the alignment options join or cross each other: LAX, LA Union Station, Central Orange County (Anaheim), Oceanside, and San Diego. The four segments include: LA Union Station/Southeast LA County to LAX, LA Union Station to Central Orange County (Anaheim), Central Orange County (Anaheim) to Oceanside and Oceanside to San Diego.

S.1.1 Segment A – LA Union Station/Southeast LA County to LAX

Three alignment options were considered to provide stand-alone or through service from LA Union Station to LAX.

- Alignment Option A1 - Interstate 405 And Interstate 10: This alignment would use existing freeway corridors from LA Union Station to LAX. The alignment allows for the possibility of adding a station to serve west Los Angeles communities in the future. This option would be a dedicated high-speed system. Station options include LA Union Station and LAX (near Terminal One).
- Alignment Option A2 - MTA Harbor Subdivision: This option would follow an existing rail alignment for most of the segment from LA Union Station to LAX. The Authority previously studied this option. Station options include LA Union Station and LAX (near Terminal One).
- Alignment Option A3 - Interstate 105 And Interstate 110. This is a southern freeway alignment option for Option A1, for the connection from LA Union Station to LAX. This option would be a dedicated high-speed system. Station options include LA Union Station and LAX (near Terminal One).

Two other options were considered, connecting LAX to southeast Los Angeles County instead of LA Union Station:

- Alignment Option A4 - Upgrade MTA Green Line To Support High Speed Train: This option would require upgrading the existing MTA Green Line to allow for higher speed trains to operate shared-use with light rail.
- Alignment Option A5 - MTA Green Line Extension: For this option, an extended Green Line would provide a light rail connection to LAX from a southeast LA County high-speed train station.

As with all segments, the No Build scenario is a potential candidate here. In this scenario, passengers would use existing shuttle bus, taxi and rental car services and the existing freeway High Occupancy Vehicle (HOV) system to travel between LA Union Station and LAX.

Figure S-2 illustrates the build options and summarizes their key distinguishing features, while Tables S-1 and S-2 rate each of the alignments and stations against the Authority's key objectives.

All three direct-connection options to LAX (Options A1, A2 and A3) provide comparable travel times of 14-18 minutes. Similarly, all are costly, due largely to the need for extensive trenched or aerial construction necessitated by constrained rights-of-way and adjacent residential neighborhoods. All three travel through areas housing significant minority and low-income populations, raising significant environmental justice issues.

Although the travel time between LA Union Station and LAX would be relatively quick, the convenience of the trip is questionable. Due to the space requirements of a high-speed train station and the layout of terminals at LAX, it is not possible to provide direct station-to-terminal service to all terminals. Passengers alighting at LAX will likely need to transfer to a people mover, moving walkway or shuttle bus for the final journey to their terminals.

There are also significant operational issues at the LA Union Station end of the trip. At full build out of the high-speed train network, up to four lines could be converging at LA Union Station – Los Angeles north to the Bay Area and Sacramento, Los Angeles to San Diego via the Inland Empire, Los Angeles to San Diego via Orange County, and the LAX connection. It is unlikely and operationally undesirable to route all trains from all directions through LA Union Station and into LAX, meaning that high-speed train passengers will likely face a transfer at LA Union Station between high-speed trains to reach LAX. This double-transfer will reduce ridership.

Finally, based on conversations with members of the South Bay Council of Governments and other groups opposed to expansion of LAX, there is significant opposition to the concept of a high-speed train connection into LAX, due to growth-inducement concerns.

The second set of options involve providing an indirect connection to LAX via the MTA Green Line Light Rail System, which runs east-west along the I-105 alignment into the LAX area in the west, and Southeast Los Angeles County in the east. The option that considers shared-use of the Green Line tracks by HSR trains (Option A4) has significant regulatory and operational barriers, and would be no faster than transferring to the Green Line for passengers, as high-speed trains would be constrained to run between Green Line trains.

Extending the Green Line into LAX, and to a high-speed train station in Southeast LA County (Option A5) is the most cost-effective fixed-guideway option, between $700 million and $1.4 billion less expensive than the direct connections. However, it is significantly slower than a direct high-speed train connection and requires a transfer at either end of the trip. As mentioned above, the double-transfer would likely be the case for many passengers, even with a direct high-speed train connection.

Finally, the no-build alternative (i.e. relying on shuttle buses, taxis and automobiles) is the slowest of all options, but carries few if any additional costs or environmental impacts, and requires only one transfer at Union Station, as these modes provide direct-to-terminal service.

S.1.2 Segment B – LA Union Station to Central Orange County (Anaheim)

Between Los Angeles and Central Orange County, the LOSSAN corridor is available for consideration. Beyond the LOSSAN options, the key objective driving the consideration of other alignments in this segment is the desire to study a fully dedicated alignment that could provide direct, transfer-free service into Orange County. Three new alignment options were defined for this segment of the Los Angeles to San Diego corridor. All three options are dedicated corridors, to allow the high-speed trains to avoid the heavy freight and commuter rail traffic on the existing LOSSAN corridor from Los Angeles to Fullerton. Such dedicated options can be compared to the incremental shared-track improvements to the LOSSAN corridor as to cost, performance, community and environmental impacts.

- Alignment Options B1a and B1b - LOSSAN Corridor: Option B1a would include a minimum of three main tracks between LA Union Station and Fullerton, while Option B1b would include 4 tracks, to increase capacity and reliability of the rail corridor for high-speed trains and other rail traffic. Option B1b would also include full grade-separation, bypass tracks at all stations, and the possibility of electrification. Under option B1a, all existing Amtrak stations would be served. Station options for B1b include LA Union Station, Norwalk (Metrolink Station) and Anaheim (Edison Field Amtrak/Metrolink Station).
- Alignment Option B2 - Interstate 5 Freeway: This alignment would follow I-5 south of the East LA interchange. This would allow for a dedicated bypass of the freight and commuter rail corridor, and a reasonably direct alignment to Central Orange County. Station options for B2 include LA Union Station, Norwalk (I-5 at Imperial Highway) and Anaheim (I-5 near Gene Autry Way).
- Alignment Option B3 - Pacific Electric (PE) Right-Of-Way: This alignment is a lightly used rail line between Paramount and Stanton, and an abandoned corridor through to Santa Ana. Its long tangent sections could support high-speed train operation. Station options for B3 include LA Union Station, Paramount (PE ROW at I-105) and Garden Grove (PE ROW at SR-22).
- Alignment Option B4 - Union Pacific Santa Ana Branch Line: This option would use an existing Union Pacific (UP) branch line from southeast LA to Anaheim, where it would connect back to I-5 alignment. Station options for B3 include LA Union Station, Norwalk (UP Branch at Imperial Highway) and Anaheim (I-5 near Gene Autry Way).

Figure S-3 illustrates the build options and summarizes their key distinguishing features, while Tables S-3 through S-5 rate each of the alignments and stations against the Authority's key objectives.

The two shared-track LOSSAN improvements (B1a and B1b) provide similar travel times in the range of 18-19 minutes. Please note that these are express times, and do not account for delays that would be suffered due to sharing the corridor with other passenger and freight traffic. Actual travel times would likely be longer, and will be determined through detailed modeling in the next phase of work, should these options be selected for further study. The "a" option would require a transfer at LA Union Station to the statewide system for travelers headed north. The "b" option would also require the transfer if it were fossil-fueled; if electrified, transfer-free operations would be possible if high-speed train manufacturers are able to meet FRA regulations in the future.

Since they involve incremental upgrades to an existing system rather than building a new system, the two LOSSAN options are the least costly of the options in this segment, between $800 million and $1.6 billion less than the dedicated options. For a higher cost relative to option "a", option "b" provides improved operational reliability and performance via a fourth track in the section with heaviest freight traffic, complete grade-separation and, potentially, electrification.

The three dedicated options (B2, B3, B4) provide travel times that are similar to or slightly better than the LOSSAN options, in the range of 16 to 19 minutes. These times are more certain, since high-speed trains would not be sharing tracks with any other traffic. These options also assure the possibility of no-transfer operations at LA Union Station. Although the three options are located within generally the same natural and man-made environment as the LOSSAN options, the potential for significant impact is higher due to the more extensive construction required relative to the incremental upgrading of an existing facility.

Of the three dedicated options, B2 (I-5) is the slowest, due to the number and size of curves on the I-5 alignment. It is the second most expensive, due to extremely constrained right-of-way in the corridor, requiring aerial construction. It would provide a Central Orange County station in Anaheim, which would have good freeway access and intermodal transit connections.

Option B3 (PE Right-of-Way) is the fastest route, due primarily to its straightness. However, it is also the longest route, and the most expensive, due to long sections of abutting residential that will likely require trenched construction to mitigate impacts. The population and employment catchment area of the central Orange County station (in Garden Grove) is comparable to that of the other central Orange County stations of the other options, which are in Anaheim. However, the Garden Grove site performs less well as to access, since it is convenient to only a single freeway. The station site, like much of the alignment, is in a residential neighborhood. Finally, both the Orange County Transportation Authority and the Gateway Cities of Southeast LA County are currently studying this corridor as a potential local transit corridor.

Option B4 (the UP Santa Ana Branch Line) is the least costly of the three dedicated route options, since it traverses largely industrial and commercial areas where at-grade operations are more feasible. It too would provide a Central Orange County station in Anaheim, similar to Option B2. However, this option also has the highest incidence of minority populations of the three dedicated alignments, particularly through the cities of Vernon, Downey and Norwalk.

S.1.3 Segment C – Central Orange County (Anaheim) to Oceanside

Similar to Segment B, a key objective driving the consideration of other alignments beyond the LOSSAN options in this segment is the desire to study a fully dedicated alignment that could provide direct, transfer-free service further south into Orange County, or northern San Diego County. A second motivation to studying alternatives to the LOSSAN corridor is the fact that in this segment the LOSSAN corridor begins to run next to the coast in south Orange County. This is a highly constrained environment with the potential for significant impacts to coastal communities and sensitive environmental areas.

Therefore, several alternatives to the LOSSAN corridor were studied that would not only provide a dedicated high-speed train corridor, but would also avoid sensitive coastal areas. The alignments studied for this segment are continuations of the options described in Segment B.

- Alignment Options C1a AND C1b - LOSSAN Corridor: There are two options in the LOSSAN corridor. Option C1a would include upgrades within the corridor, including grade separation at San Juan Capistrano and San Clemente. Option C1b would include upgrades and bypass alignments around the environmentally sensitive coastal communities and regions of south Orange County. Under option C1a, all existing Amtrak stations would be served. Station options for C1b include the Irvine Transportation Center (ITC) and the Oceanside Transportation Center (OTC).
- Alignment Option C2 - Interstate 5 Freeway: This alignment would continue along I-5 in Orange County and through Camp Pendleton, providing a dedicated high-speed alignment and bypassing constrained sections of the LOSSAN corridor. Station options for C2 include Irvine (I-5 at Jeffrey Road) and Oceanside (I-5 at Oceanside Boulevard).
- Alignment Option C3 - San Joaquin Corridor (SR-73) With I-5: This would be a dedicated alignment option, continuing from the PE right-of-way in Garden Grove. This would be a southern highway alternative to Option C2 (which follows I-5 through Santa Ana, Tustin, and Irvine), and would pass through some less developed parts of Orange County. Station options for C3 include Newport Beach (SR-73 at Jamboree Road) and Oceanside (I-5 at Oceanside Boulevard).
- Alignment Option C4 - Interstate 5 And Foothill Corridor (SR-241): This option would use the right-of-way of the existing and proposed alignments of the SR-241 Toll Road in eastern Orange County. This alignment option would bypass the coastal communities of southern Orange County and join I-5 alignment from San Onofre to Oceanside. Station options for C2 include Irvine (I-5 at Jeffrey Road) and Oceanside (I-5 at Oceanside Boulevard).

Figure S-4 illustrates the build options and summarizes their key distinguishing features, while Tables S-6 and S-7 rate each of the alignments and stations against the Authority's key objectives.

Both shared-track LOSSAN improvements (C1a and C1b) provide comparable travel times of 32-34 minutes, again, likely understated since the constraints posed by other traffic on the line were not included. Again, relative to the other dedicated options they are the least costly, between $1 billion and $2.5 billion less than the dedicated alignments. For a higher capital cost relative to option "a", the "b" option provides a higher level of environmental mitigation by taking the tracks "off the beach" in San Clemente, and out of the historical downtown of San Juan Capistrano, and also straightens two slow curves in Orange and Dana Point.

The three dedicated options (C2, C3, C4) provide travel times that are similar to or slightly longer than the LOSSAN options, in the range of 34 to 37 minutes. These times are more certain, since high-speed trains would not be sharing tracks with any other traffic. These options assure the possibility of no-transfer operation at LA Union Station.

Option C2 (I-5) is the fastest of the dedicated options. It is also the costliest, since the number and size of horizontal and vertical curves on I-5 require extensive aerial and tunnel construction to maintain speeds. This option avoids the sensitive areas in San Juan Capistrano and San Clemente, although there is the potential for impact alongside the I-5 corridor, which is abutted by commercial and industrial uses in both areas.

Option C3 (San Joaquin Corridor) is almost as expensive as the I-5 option due to its rolling terrain, which requires extensive tunneling. The population and employment catchment area of the south Orange County station (in Newport Beach) is comparable to that of the other south Orange County stations of the other options, which are in Irvine. However, the Newport Beach site performs less well as to access, since it is convenient to only a single freeway. In addition, the station site is in an area of residential development and open space, raising concerns about visual and land use compatibility.

Option C4 (Foothill Corridor) is the least costly of the three dedicated route options, due to the possibility of joint construction with the proposed extension of the Foothill Corridor. However, it is also the longest and slowest of the three. Finally, the availability of this option is uncertain, as it depends on the extension of the Foothill corridor, a toll road project that is environmentally controversial and uncertain.

S.1.4 Segment D – Oceanside to San Diego

Similar to Segment C, the key objectives driving the consideration of other alignments beyond the LOSSAN corridor in this segment are the desire to study a fully dedicated alignment that could provide direct, transfer-free service into San Diego County, and to avoid sensitive coastal areas. The alignments studied for this segment are primarily continuations of the options described in Segment C.

In San Diego County only two distinct alignments were studied: LOSSAN and I-5. Due to the terrain and pattern of residential development in coastal San Diego County, no other options were determined feasible.

- Alignment Options D1a and D1b - LOSSAN Corridor: Option D1a would include the tunnel under University Towne Centre (UTC) from the *Corridor Evaluation*[3]. Option D1b would include a tunnel under Camino Del Mar, and a more direct tunnel alignment under I-5 instead of UTC, to increase speed. Under option D1a, all existing Amtrak stations would be served, and there would be a new

[3] Parsons Brinckerhoff. *California High-Speed Rail Corridor Evaluation.* Prepared for California High-Speed Rail Authority, December 1999.

station at University Towne Centre (La Jolla Village Drive and Genesee Avenue). Station options for B1b include Solana Beach (Amtrak/Coaster Station) and the Santa Fe Depot in downtown San Diego.

- Alignment Option D2 - Interstate 5 Freeway: This would be the only freeway option for a dedicated high-speed alignment along the coast in San Diego, and would allow bypassing of sensitive coastal areas along the LOSSAN corridor. Station options for D2 include Solana Beach (I-5 at Lomas Santa Fe Drive) and San Diego Airport.

Figure S-5 illustrates the build options and summarizes their key distinguishing features, while Tables S-8 through S-12 rate each of the alignments and stations against the Authority's key objectives.

Both shared-track LOSSAN improvements (D1a and D1b) provide comparable travel times of 23-24 minutes, again, likely understated since the constraints posed by other traffic on the line were not included. Option "b" is slightly faster since it takes a more direct tunnel along I-5 in the University City area, rather than deviating under UTC. However, it does so at the expense of being able to provide a station at UTC, a station whose underground location would make it costly and require deep tunneling under private property, but which is a significant population and employment center and an emerging regional transportation hub. The comparable "b" option station is at Solana Beach, which provides good intermodal access, but has less convenient freeway access and potentially constrained parking.

Option D1a is the least costly, about $1.2 billion less than the I-5 option. The "b" option involves extensive trenching and tunneling and approaches the cost of the dedicated I-5 option. For the extra capital cost, the "b" option provides a higher level of environmental mitigation by providing grade separations through Oceanside, Carlsbad, Encinitas, and downtown San Diego, and by moving the tracks away from the unstable bluffs at Del Mar.

The dedicated option (D2) provides a travel time similar to the LOSSAN options, of about 21 minutes, but does not go downtown. This time is more certain, since high-speed trains would not be sharing tracks with any other traffic. This option assures the possibility of no-transfer operations at LA Union Station.

Option D2 is also the costliest option, since the number and size of horizontal and vertical curves on I-5 require extensive aerial to maintain speeds. This option avoids the sensitive coastal areas. However, in many places, particularly at lagoon crossings, it is not very distant from the coast, and shares many of the environmental issues and sensitivities of the LOSSAN corridor. Due to the constrained right-of-way along the I-5 corridor, there exists the potential for impact to adjacent land uses, which are predominately commercial and industrial but include significant residential areas. Due to the need for aerial construction, there is significant potential for visual intrusion, particularly interference with ocean and lagoon views.

Station sites on the I-5 alignment would be problematic. Suitable land for stations is scarce, and the development of such new stations would be incompatible with the emerging Smart Growth principles of San Diego County, which stress the support and development of existing transportation hubs.

Also, as an I-5 alignment would be exclusively used by high-speed trains, the coastal communities would still be faced with issues in the LOSSAN corridor, and would in fact be hosting two parallel rail lines. It is highly likely that the communities would demand that the I-5 alignment be used by all rail services. This would diminish the performance of a high-speed train, raising questions about the cost-effectiveness of building a completely new infrastructure that is not fully dedicated to high-speed service. It would also force the relocation of all existing Amtrak and commuter rail stations into the I-5 corridor, likely causing significant disruption to abutting land uses.

Figure S-1

Proposed Alignment and Station Options

Figure S-2

Proposed Alternatives - LAX to LA Union Station - Segment A

ALIGNMENT A1

- *Dedicated track*
- *18.2 minutes*
- *23.2 miles (37.3 km)*
- *Highest cost*
- *Environmental Justice: Minority population of 105,000; 4,525 per Mile (2,815 per km)*
- *Impacts to several adjacent communities & neighborhoods*
- *Limited ROW*
- *Need to transfer at LAX*

ALIGNMENT A2

- *Dedicated track*
- *14.4 minutes*
- *15.8 miles (25.4 km)*
- *High cost*
- *Environmental Justice: Minority population of 43,000; 2,722 per Mile (1,693 per km)*
- *Impacts to several adjacent communities & neighborhoods*
- *ROW owned by MTA; may use as commuter line*
- *Need to transfer at LAX*

ALIGNMENT A3

- *Dedicated track*
- *17.0 minutes*
- *20.6 miles (33.2 km)*
- *Very high cost*
- *Environmental Justice: Minority population of 154,000; 7,475 per Mile (4,639 per km)*
- *Impacts to several adjacent communities & neighborhoods*
- *Limited ROW*
- *Need to transfer at LAX*

ALIGNMENT A4

- *Shared track with GreenLine/ shared capacity*
- *35 minutes*
- *21.1 miles (38.8 km)*
- *Environmental Justice: Minority population of 128,000; 6,066 per Mile (3,299 per km)*
- *Limited ROW*
- *Construction, Operational and Regulatory Fatal Flaws*
- *Need to transfer at LAX*

ALIGNMENT A5

- *Transfer to GreenLine*
- *35 minutes*
- *21.1 miles (38.8 km)*
- *Least cost*
- *Environmental Justice: Minority population of 128,000; 6,066 per Mile (3,299 per km)*
- *Double transfer*

4 0 4 Miles

4 0 4 Kilometers

(Travel times given are express times only)

Figure S-3

Proposed Alternatives - Union Station to Central Orange County (Anaheim) - Segment B

ALIGNMENT B1a

- *Shared track/shared capacity*
- *19.4 minutes (longer in mixed traffic)*
- *30 miles (48.3 km)*
- *Least cost*
- *10,089,905 people served*
- *Environmental Justice: Minority population of 40,000; 1,333 per Mile (828 per km)*

ALIGNMENT B1b

- *Shared track/shared capacity*
- *18.3 minutes (longer in mixed traffic)*
- *30 miles (48.3 km)*
- *Moderate cost*
- *10,089,905 people served*
- *Environmental Justice: Minority population of 40,000; 1,333 per Mile (828 per km)*
- *Some ROW acquisition required*

ALIGNMENT B2

- *Dedicated track*
- *19.0 minutes*
- *28.3 miles (45.5 km)*
- *High cost*
- *10,367,191 people served*
- *Environmental Justice: Minority population of 78,000; 2.756 per Mile (1,714 per km)*
- *Second level aerial construction issues*
- *Limited ROW*
- *Southeast LA - station site abuts residential areas*

ALIGNMENT B3

- *Dedicated track*
- *16.4 minutes - fastest*
- *32.2 miles (51.8 km) - longest*
- *Highest cost*
- *10,890,544 people served*
- *Environmental Justice: Minority population of 89,000; 2,764 per Mile (1,718 per km)*
- *Weaker intermodal connections and freeway access*
- *Highest adjacent residential, particularly at stations*
- *Corridor being studied for local transit*

ALIGNMENT B4

- *Dedicated track*
- *17.1 minutes*
- *28.7 miles (46.1 km)*
- *High cost*
- *10,406,864 people served*
- *Environmental Justice: Minority population of 157,000; 5,470 per Mile (3,406 per km)*
- *Southeast LA - station site abuts residential areas*

4 0 4 Miles

4 0 4 Kilometers

(Travel times given are express times only)

Figure S-4

Proposed Alternatives - Central Orange County (Anaheim) to Oceanside - Segment C

ALIGNMENT C1a

- *Shared track/shared capacity*
- *33.9 minutes (longer in mixed traffic)*
- *55.5 miles (89.2 km)*
- *Least cost*
- *4,224,461 people served*
- *Construction & ROW issues in realigning existing tracks*
- *Remains in/near LOSSAN corridor in sensitive areas*
- *Several threatened & endangered species, parks and wildlife refuges along the coast*

ALIGNMENT C1b

- *Shared track/shared capacity*
- *32.1 minutes (longer in mixed traffic)*
- *56.1 miles (90.3 km)*
- *Moderate cost*
- *4,224,461 people served*
- *Construction & ROW issues in realigning existing tracks*
- *Deviates from LOSSAN corridor in sensitive areas*
- *Grade-separated construction in sensitive areas*
- *Several threatened & endangered species, parks and wildlife refuges along the coast*

ALIGNMENT C2

- *Dedicated track*
- *33.7 minutes*
- *55.1 miles (88.6 km)*
- *Very high cost*
- *4,714,864 people served*
- *Second level aerial construction issues*
- *Limited ROW*
- *Several threatened & endangered species along the coast*

ALIGNMENT C3

- *Dedicated track*
- *34.5 minutes*
- *57.6 miles (92.7 km)*
- *Highest cost*
- *4,841,680 people served*
- *Limited ROW along freeways*
- *Weaker intermodal connections and freeway access*

ALIGNMENT C4

- *Dedicated track*
- *36.6 minutes - slowest*
- *61.5 miles (99.0 km) - longest*
- *Very high cost*
- *4,714,864 people served*
- *Avoids sensitive areas in San Juan Capistrano and San Clemente*
- *Construction issues; Uncertainty as to the final alignment of SR-241*

4 0 4 Miles

4 0 4 Kilometers

(Travel times given are express times only)

Figure S-5

Proposed Alternatives - Oceanside to San Diego - Segment D

ALIGNMENT D1a

- *Shared track/shared capacity*
- *24.5 minutes (longer in mixed traffic)*
- *37.3 miles (60.0 km)*
- *Least cost*
- *2,609,220 people served*
- *Remains in/near LOSSAN corridor in sensitive areas*
- *Several threatened and endangered species, parks and wildlife refuges along corridor*
- *Unstable bluffs - Encinitas, Del Mar, Solana Beach*

ALIGNMENT D1b

- *Shared track/shared capacity*
- *23.2 minutes (longer in mixed traffic)*
- *35.8 miles (57.7 km)*
- *Very high cost*
- *2,217,289 people served*
- *Deviates from LOSSAN corridor in sensitive areas*
- *Several threatened and endangered species, parks and wildlife refuges along corridor*
- *Unstable bluffs - Encinitas, Solana Beach*

ALIGNMENT D2

- *Dedicated track*
- *21.4 minutes*
- *33.8 miles (54.5 km)*
- *Very high cost*
- *2,379,082 people served*
- *Third level aerial construction issues*
- *Does not address community concerns with existing rail service*
- *New stations are constrained and not generally compatible with adopted Smart Growth principles*
- *Significant right-of-way acquisitions issues*
- *Predominantly aerial - visual and barrier effects*
- *Several threatened and endangered species, parks and wildlife refuges along corridor*

4 0 4 Miles

4 0 4 Kilometers

(Travel times given are express times only)

Table S-1
Los Angeles to San Diego via Orange County – High-Speed Train Alignment Attainment of Objectives
LA Union Station/Southeast LA County to LAX Segment[4]

OBJECTIVE	Alignment Option A1	Alignment Option A2	Alignment Option A3	Alignment Option A5
Maximize Ridership/Revenue Potential	3	4	3	2
Maximize Connectivity and Accessibility	4	4	4	3
Minimize Operating and Capital Costs	1	2	1	4
Maximize Compatibility with Existing and Planned Development	3	4	3	4
Minimize Impacts to Natural Resources	3	2	3	3
Minimize Impacts to Social and Economic Resources	1	2	1	3
Minimize Impacts to Cultural Resources	2	2	2	3
Maximize Avoidance of Areas with Geologic and Soils Constraints	3	3	3	3
Maximize Avoidance of Areas with Potential Hazardous Materials	2	2	2	2

1 2 3 4 5
Highly Unfavorable Highly Favorable

[4] Option A4 is not included in the Attainment of Objectives Matrix.

Table S-2
Los Angeles to San Diego via Orange County – High-Speed Train Alignment Attainment of Objectives
LA Union Station to Central Orange County (Anaheim) Segment

OBJECTIVE	Alignment Option B1a	Alignment Option B1b	Alignment Option B2	Alignment Option B3	Alignment Option B4
Maximize Ridership/Revenue Potential	2	3	3	4	4
Maximize Connectivity and Accessibility	4	4	3	3	3
Minimize Operating and Capital Costs	5	4	2	1	2
Maximize Compatibility with Existing and Planned Development	3	3	2	2	2
Minimize Impacts to Natural Resources	3	3	4	3	4
Minimize Impacts to Social and Economic Resources	3	3	2	2	2
Minimize Impacts to Cultural Resources	3	3	3	4	4
Maximize Avoidance of Areas with Geologic and Soils Constraints	3	3	3	3	3
Maximize Avoidance of Areas with Potential Hazardous Materials	2	2	3	3	3

1 2 3 4 5
Highly Unfavorable — Highly Favorable

Table S-3
Los Angeles to San Diego via Orange County – High-Speed Train Alignment Attainment of Objectives
Central Orange County (Anaheim) to Oceanside Segment

OBJECTIVE	Alignment Option C1a	Alignment Option C1b	Alignment Option C2	Alignment Option C3	Alignment Option C4
Maximize Ridership/Revenue Potential	3	3	4	4	3
Maximize Connectivity and Accessibility	4	4	3	2	3
Minimize Operating and Capital Costs	4	3	1	1	2
Maximize Compatibility with Existing and Planned Development	2	3	3	3	3
Minimize Impacts to Natural Resources	2	2	2	2	2
Minimize Impacts to Social and Economic Resources	2	3	3	3	4
Minimize Impacts to Cultural Resources	1	2	3	3	3
Maximize Avoidance of Areas with Geologic and Soils Constraints	3	3	3	3	3
Maximize Avoidance of Areas with Potential Hazardous Materials	2	2	2	5	5

1 2 3 4 5
Highly Unfavorable — Highly Favorable

Table S-4
Los Angeles to San Diego via Orange County – High-Speed Train Alignment Attainment of Objectives
Oceanside to San Diego Segment

OBJECTIVE	Alignment Option D1a	Alignment Option D1b	Alignment Option D2
Maximize Ridership/Revenue Potential	3	4	4
Maximize Connectivity and Accessibility	4	3	2
Minimize Operating and Capital Costs	4	2	2
Maximize Compatibility with Existing and Planned Development	2	3	2
Minimize Impacts to Natural Resources	2	2	2
Minimize Impacts to Social and Economic Resources	2	3	3
Minimize Impacts to Cultural Resources	2	2	2
Maximize Avoidance of Areas with Geologic and Soils Constraints	2	3	3
Maximize Avoidance of Areas with Potential Hazardous Materials	2	2	3

1 2 3 4 5
Highly Unfavorable Highly Favorable

Table S-5
Los Angeles to San Diego via Orange County – High-Speed Train Alignment Attainment of Objectives
LA Union Station and LAX

OBJECTIVE	LAX	LA Union Station
Maximize Ridership/Revenue Potential	3	5
Maximize Connectivity and Accessibility	4	5
Minimize Operating and Capital Costs	2	3
Maximize Compatibility with Existing and Planned Development	4	4
Minimize Impacts to Natural Resources	5	5
Minimize Impacts to Social and Economic Resources	4	4
Minimize Impacts to Cultural Resources	5	4
Maximize Avoidance of Areas with Geologic and Soils Constraints	3	3
Maximize Avoidance of Areas with Potential Hazardous Materials	5	5

1 2 3 4 5
Highly Unfavorable Highly Favorable

Table S-6
Los Angeles to San Diego via Orange County – High-Speed Train Alignment Attainment of Objectives
Southeast LA County Stations

OBJECTIVE	Norwalk - LOSSAN	Norwalk - Interstate 5	Norwalk - Union Pacific	Paramount
Maximize Ridership/Revenue Potential	3	3	3	4
Maximize Connectivity and Accessibility	4	3	3	3
Minimize Operating and Capital Costs	4	3	3	2
Maximize Compatibility with Existing and Planned Development	4	3	3	2
Minimize Impacts to Natural Resources	5	5	5	5
Minimize Impacts to Social and Economic Resources	4	3	3	2
Minimize Impacts to Cultural Resources	5	5	5	5
Maximize Avoidance of Areas with Geologic and Soils Constraints	3	3	3	3
Maximize Avoidance of Areas with Potential Hazardous Materials	4	5	5	5

1 2 3 4 5
Highly Unfavorable Highly Favorable

Table S-7
Los Angeles to San Diego via Orange County – High-Speed Train Alignment Attainment of Objectives
Central Orange County Stations

OBJECTIVE	Anaheim - LOSSAN	Anaheim - Interstate 5	Garden Grove
Maximize Ridership/Revenue Potential	3	3	3
Maximize Connectivity and Accessibility	5	4	3
Minimize Operating and Capital Costs	4	2	2
Maximize Compatibility with Existing and Planned Development	4	3	2
Minimize Impacts to Natural Resources	3	3	3
Minimize Impacts to Social and Economic Resources	4	3	2
Minimize Impacts to Cultural Resources	5	5	5
Maximize Avoidance of Areas with Geologic and Soils Constraints	3	3	3
Maximize Avoidance of Areas with Potential Hazardous Materials	4	5	4

1 2 3 4 5
Highly Unfavorable Highly Favorable

Table S-8
Los Angeles to San Diego via Orange County – High-Speed Train Alignment Attainment of Objectives
Southern Orange County Stations

OBJECTIVE	Irvine - LOSSAN	Irvine - Interstate 5	Newport Beach
Maximize Ridership/Revenue Potential	3	3	4
Maximize Connectivity and Accessibility	4	3	2
Minimize Operating and Capital Costs	4	3	2
Maximize Compatibility with Existing and Planned Development	4	3	2
Minimize Impacts to Natural Resources	4	4	3
Minimize Impacts to Social and Economic Resources	4	4	3
Minimize Impacts to Cultural Resources	5	5	5
Maximize Avoidance of Areas with Geologic and Soils Constraints	3	3	3
Maximize Avoidance of Areas with Potential Hazardous Materials	5	5	5

1 2 3 4 5
Highly Unfavorable Highly Favorable

Table S-9
Los Angeles to San Diego via Orange County – High-Speed Train Alignment Attainment of Objectives
North San Diego County Stations

OBJECTIVE	Oceanside - LOSSAN	Oceanside - Interstate 5
Maximize Ridership/Revenue Potential	2	2
Maximize Connectivity and Accessibility	4	3
Minimize Operating and Capital Costs	4	3
Maximize Compatibility with Existing and Planned Development	3	2
Minimize Impacts to Natural Resources	3	3
Minimize Impacts to Social and Economic Resources	4	3
Minimize Impacts to Cultural Resources	3	3
Maximize Avoidance of Areas with Geologic and Soils Constraints	3	3
Maximize Avoidance of Areas with Potential Hazardous Materials	4	5

1 2 3 4 5
Highly Unfavorable Highly Favorable

Table S-10
Los Angeles to San Diego via Orange County – High-Speed Train Alignment Attainment of Objectives
Central San Diego County Stations

OBJECTIVE	Solana Beach - LOSSAN	Solana Beach - Interstate 5	University Towne Centre
Maximize Ridership/Revenue Potential	2	2	3
Maximize Connectivity and Accessibility	3	2	4
Minimize Operating and Capital Costs	3	2	1
Maximize Compatibility with Existing and Planned Development	4	2	3
Minimize Impacts to Natural Resources	5	4	3
Minimize Impacts to Social and Economic Resources	3	3	3
Minimize Impacts to Cultural Resources	3	3	3
Maximize Avoidance of Areas with Geologic and Soils Constraints	3	3	2
Maximize Avoidance of Areas with Potential Hazardous Materials	5	5	5

1 2 3 4 5
Highly Unfavorable Highly Favorable

Table S-11
Los Angeles to San Diego via Orange County – High-Speed Train Alignment Attainment of Objectives
San Diego Airport and Santa Fe Depot

OBJECTIVE	Santa Fe Depot	San Diego Airport
Maximize Ridership/Revenue Potential	4	4
Maximize Connectivity and Accessibility	4	3
Minimize Operating and Capital Costs	4	3
Maximize Compatibility with Existing and Planned Development	3	3
Minimize Impacts to Natural Resources	5	5
Minimize Impacts to Social and Economic Resources	5	4
Minimize Impacts to Cultural Resources	3	4
Maximize Avoidance of Areas with Geologic and Soils Constraints	3	3
Maximize Avoidance of Areas with Potential Hazardous Materials	5	4

1 2 3 4 5
Highly Unfavorable Highly Favorable

1.0 INTRODUCTION

Since 1992, extensive information has been gathered and preliminary evaluation has been completed concerning the potential environmental effects associated with numerous high-speed train corridor alternatives throughout California. From feasibility studies through conceptual design, a variety of technical studies have been undertaken to address the engineering, operational, financial, ridership, and environmental aspects of such a system. The findings of these studies concluded that California would benefit substantially from high-speed train transportation. Because of the anticipated benefits and the proven need for additional transportation options, the further evaluation of a high-speed train system is seen as the next logical step in the development of California's transportation infrastructure.

The current stage of project development for a statewide high-speed train system is designed to further optimize alignments, avoid/minimize environmental impacts, and develop a more accurate cost figure based on a more refined level of engineering and environmental analysis. As such, the California High-Speed Rail Authority (Authority) has initiated a formal environmental clearance process through the preparation of a state program-level Environmental Impact Report (EIR) and a federal Tier I Environmental Impact Statement (EIS) or Program EIR/EIS. The Program EIR/EIS will satisfy the requirements of the California Environmental Quality Act (CEQA) and National Environmental Policy Act (NEPA) for the first tier of environmental review. As part of the Program EIR/EIS, a number of alternatives are being evaluated including a No Build Alternative, High-Speed Train Alternative(s), and Other Modal Alternatives (aviation, highway, and conventional passenger rail).

To accomplish this program environmental effort, the Authority has divided the state study area into five regions: Bay Area-to-Merced, Sacramento-to-Bakersfield, Bakersfield-to-Los Angeles, Los Angeles-Orange County-San Diego, and Los Angeles-to-San Diego via the Inland Empire.

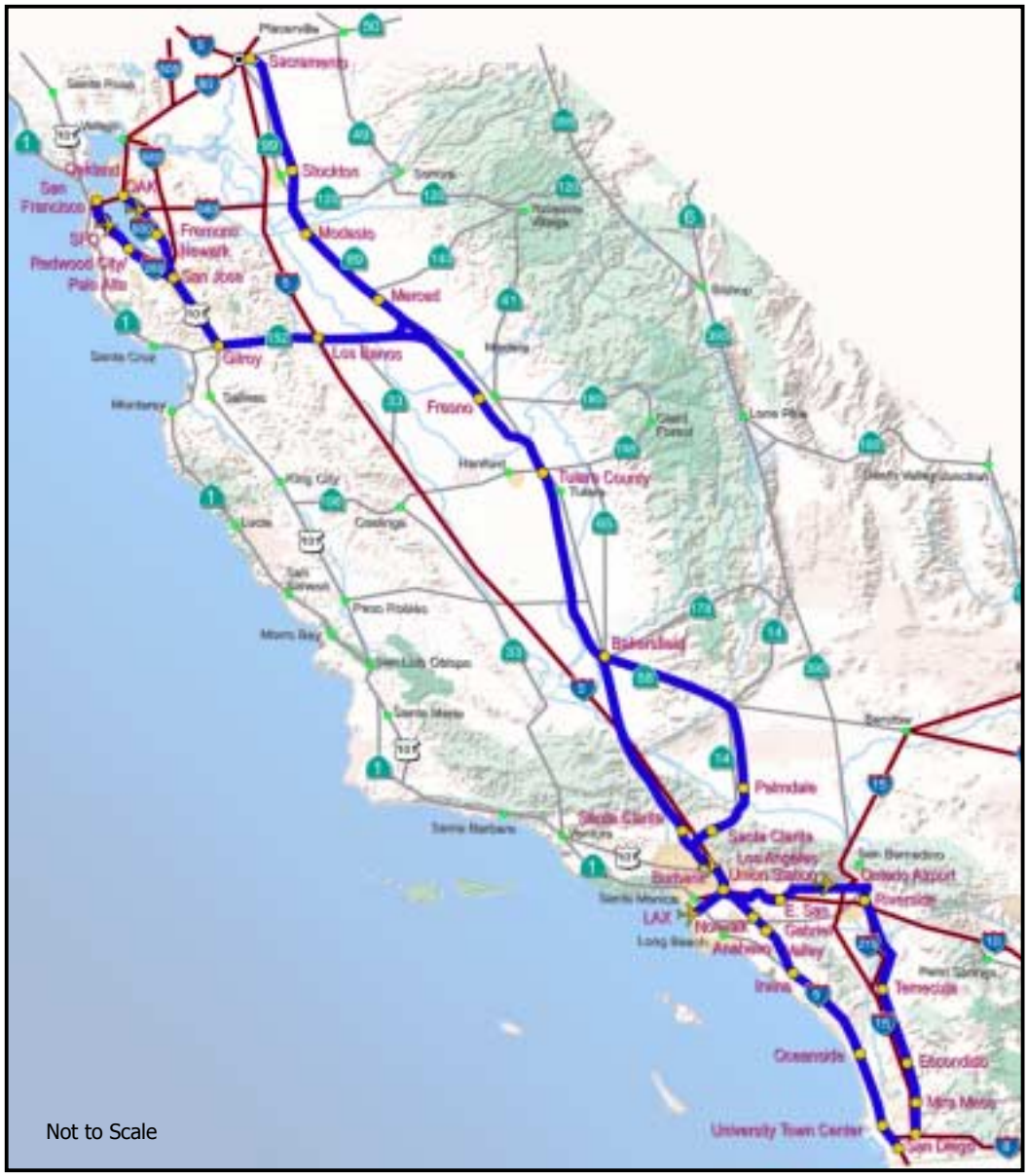
1.1 PURPOSE

Within the High-Speed Train Alternative, there is a range of high-speed train alignment and station location options to be considered. Most of these options have been evaluated in prior studies and have been presented to the previous California Intercity High-Speed Rail Commission and the current Authority. Some corridors were carried forward for further consideration while others have been removed from further study based on their relative merit and viability for potential implementation as part of a statewide high-speed train system. Those corridors that have been carried forward are illustrated in Figure 1.1-1 and documented in the Authority's June 2000, *Final Business Plan*[5] and the December 1999, *California High-Speed Rail Corridor Evaluation*.[6]

The purpose of the Alignment Screening Evaluation is to consider all reasonable and practical alignment and station options at a consistent level of analysis and focus the program environmental analysis on the most viable of these alignment and station options. The initial set of alignments and station locations was identified by reviewing prior Commission and Authority studies, through meetings with elected officials, and through the environmental scoping process.

[5] California High-Speed Rail Authority. *Building a High-Speed Train System for California, Final Business Plan*, June 2000.
[6] Parsons Brinckerhoff. *California High-Speed Rail Corridor Evaluation.* Prepared for California High-Speed Rail Authority, December 1999.

Figure 1.1-1
Recommended Corridors to be Studied in the Environmental Process



Source: California High-Speed Rail Authority. *Building a High-Speed Train System for California, Final Business Plan,* 2000.

The results of this screening process and information differentiating the alignment and station options are documented herein for the Los Angeles to San Diego via Orange County region. Similar reports are being prepared for the other four regions. Each of the region screening reports will be summarized into a Statewide High-Speed Train Alignments/Stations Screening Evaluation that will be presented to the Authority Board. Based on recommendations by the Authority staff, the Board will select alignments and stations to be carried forward for more detailed analysis in the Program EIR/EIS.

1.2 BACKGROUND

The California Intercity High-Speed Rail Commission was established in 1993 by Senate Concurrent Resolution (SCR) 6 to investigate the feasibility of a high-speed train system for California, specifically, a system connecting the San Francisco Bay Area, Los Angeles, San Diego, and Sacramento. To address this question of feasibility, the Commission successfully conducted a series of technical studies encompassing ridership and revenue forecasts; economic impact and benefit cost analyses; institutional and financing options; corridor evaluation and environmental impacts and constraints analyses; and preliminary engineering feasibility studies. Based on these studies, the Commission determined that a high-speed train system is technically, environmentally, and economically feasible and set forth recommendations for the technology, corridors, financing, and operation for this system.

The California High-Speed Rail Authority was created by the state Legislature in 1996 (Chapter 796 of the Statutes of 1996 — Senate Bill 1420, Kopp and Costa) to be an implementing agency that would construct, operate, and fund a statewide, intercity high-speed passenger rail system. Based on recently completed studies, evaluations, and previous analysis, the Authority has developed a plan to implement a statewide high-speed train system in California. The current proposal is presented in the Authority's *Business Plan*. The plan describes a 700-mile (1,126-kilometer) -long system capable of speeds in excess of 200 miles per hour (mph) (320 kilometers per hour [km/h]) on dedicated, fully grade-separated tracks with state-of-the-art safety, signaling, and automated train control systems. The system would serve the major metropolitan centers of California.

Beginning in 1992, several studies pertaining to planning, engineering, ridership/revenue, financing, and economic impact have been completed under the direction of the California Department of Transportation (Caltrans), the past Commission, and the current Authority. These studies provided information that formed the basis of the decisions made and direction of the continuing studies. Because of the nature of this initial screening evaluation, this report primarily references the three planning and engineering studies that have been completed. While these studies differed in terms of their specific scopes of work, they all shared the common focus of identifying potential corridors for the implementation of high-speed train lines and evaluating the feasibility and viability of these corridors. Analysis of environmental constraints through use of existing databases and identification of potential impacts were key components of these studies. The studies were completed in consecutive order, allowing for each subsequent study to benefit from, and build on, the work completed in the prior study. Each of the three studies is described in detail in the *California High-Speed Rail Corridor Evaluation - Environmental Summary Report.*[7] Public involvement was an important part of the feasibility studies. The public was updated on the study progress and key decision points with newsletters and access to the Authority's website.

1.2.1 Los Angeles – Bakersfield Preliminary Engineering Feasibility Study (1994)[8]

Completed in 1994, this study analyzed the feasibility of constructing a high-speed train crossing of the Tehachapi Mountains in Southern California. After considering a broad range of alternative alignments, the study focused on the most viable routes. Two main corridors between Los Angeles and Bakersfield were considered feasible in terms of cost, travel time, and environmental impact: I-5 Grapevine and Palmdale-Mojave. The corridors studied traversed a variety of terrain (urban development, mountains, valley floor, etc.), allowing the engineering and costing analyses to be applicable to other portions of the

[7] Parsons Brinckerhoff. *California High-Speed Rail Corridor Evaluation - Environmental Summary.* Prepared for California High-Speed Rail Authority, April 2000.
[8] Parsons Brinckerhoff. *Los Angeles - Bakersfield High-Speed Ground Transportation Preliminary Engineering Feasibility Study Final Report*. Prepared for Caltrans, December 1994.

state. Because of this applicability, work performed for the Los Angeles–Bakersfield study provided an important foundation for the subsequent statewide corridor evaluation studies.

1.2.2 California High-Speed Rail Corridor Evaluation & Environmental Constraints Analysis (1996)[9]

This study was conducted in three phases and was completed in 1996. The first phase defined the most promising corridor alignments for linking the San Francisco Bay Area and Los Angeles. During the second phase, these alternative corridors between Los Angeles and the Bay Area were examined in more detail. The third phase examined potential high-speed train system extensions to Sacramento, San Bernardino/Riverside, Orange County, and San Diego. The study identified station locations and estimated travel times; developed construction, operation, and maintenance cost estimates; analyzed environmental constraints and possible mitigation measures; and, in an iterative process with the Ridership Study, developed a conceptual operating plan. The corridors recommended for further study in Phases 2 and 3 were refined in the corridor evaluation studies completed by the Authority.

1.2.3 California High-Speed Rail Corridor Evaluation (2000)[10]

In September of 1998, the Authority commissioned a *Corridor Evaluation* study to assess and evaluate the viability of various corridors throughout the state for implementation as part of a statewide high-speed train system. To address new issues raised by local and regional agencies, further corridor investigations and evaluations were conducted in several areas of the State and compared in the context of updated information on previously studied routes. The Authority was mandated to move forward in a manner that was consistent with, and continued the work of the Commission. Using the Commission's recommended corridors as a foundation, potential corridors were further evaluated on the basis of capital, operating and maintenance costs; travel times; and engineering, operational, and environmental constraints. The corridors were compared and evaluated on a regional basis and as part of a statewide system. From this study, the Authority identified corridors to be included in the current stage of project development as part of the Program EIR/EIS.

[9] Parsons Brinckerhoff. *California High-Speed Rail Corridor Evaluation and Environmental Constraints Analysis.* Prepared for California Intercity High-Speed Rail Commission, June 1996.
[10] Parsons Brinckerhoff. *California High-Speed Rail Corridor Evaluation.* Prepared for California High-Speed Rail Authority, December 1999.

2.0 PARAMETERS/ASSUMPTIONS AND EVALUATION METHODOLOGY

Unless otherwise noted, the objectives, parameters, criteria, and methodologies described in this report are consistent with those applied in previous California high-speed train studies and documented in the *California High-Speed Train Program EIR/EIS*, *Task 1.5.2 – High-Speed Train Alignment/Station Screening Evaluation Methodology*.[11]

2.1 PARAMETERS AND ASSUMPTIONS

High-speed train alignment and station options were developed through consistent application of system, engineering, and operating parameters as described in Task 1.5.2. The parameters and assumptions applied are consistent with those applied in previous planning and engineering studies and are based on accepted engineering practice, the criteria and experiences of other railway and high-speed train systems, and recommendations of VHS and maglev manufacturers.

2.1.1 Statewide Parameters/Assumptions

The design, cost, and performance parameters used in developing the alignment and station options are based on two technology groups (classified by speed) (Figure 2.1.1). The Very High Speed (VHS) group includes trains capable of maximum operating speeds near 220 mph (350 km/h) utilizing steel-wheel-on-steel-rail technology. Requirements for a VHS system include a dedicated, fully grade-separated right-of-way with overhead catenary for electric propulsion. It is possible to integrate a VHS system into existing conventional rail lines in congested urban areas given resolution of certain equipment and operating compatibility issues. The magnetic levitation (Maglev) group utilizes magnetic forces to lift and propel the train along a guideway and is designed for maximum operating speeds above that of VHS technology. A maglev system requires a dedicated guideway and may share right-of-way BUT not track with conventional train systems.

Figure 2.1-1
VHS and Maglev Technology

VHS Train (Germany ICE)

Maglev (Transrapid)

[11] Parsons Brinckerhoff. *California High-Speed Train Program EIR/EIS, Task 1.5.2 – High-Speed Train Alignments/Stations Screening Evaluation Methodology*. Prepared for California High-Speed Rail Authority, May 2001.

High-speed train system engineering design parameters used in developing the alignments were documented in Task 1.5.2 and include speeds, geometry, and clearances for both steel-wheel-on-steel-rail (VHS) and maglev high-speed train technologies. The parameters and criteria, summarized in Table 2.1-1, are consistent with previous California high-speed train studies and are based on accepted engineering practice, the criteria and experiences of other railway and high-speed train systems, and recommendations of VHS and maglev manufacturers.

Table 2.1-1
Summary of Engineering Design Parameters

Parameter	Very High-Speed	Maglev
Double Track	Full	Full
Power Source	Electric	Electric
Grade-Separations	Full	Full
POTENTIAL FOR SHARED-USE	Yes	No
Corridor Width		
❑ **Desirable**	100 ft (30.4 m)	100 ft (30.4 m)
❑ **Minimum**	50 ft (15.2 m)	50 ft (15.2 m)
Top Speed	220 mph (350 km/h)	240 mph[(1)] (385 km/h)
Average Speed	125-155 mph (200-250 km/h)	145-175 mph (230-280 km/h)
Acceleration	0.4-1.3 mph/s[3] (0.6-2.1 km/h/s[4])	1.1-1.9 mph/s (1.8-3.2 km/h/s)
Deceleration	1.2 mph/s (1.9 km/h/s)	1.8 mph/s (2.9 km/h/s)
MINIMUM HORIZONTAL RADIUS	500-650 ft (150-200 m)	1,150 ft (350 m) (2)
Minimum Horizontal Radius (at top speed)	15,600 ft @ 220 mph (4,750 m @ 350 km/h)	11,500 ft @ 240 mph (3,500 m @ 385 km/h)
Superelevation		
❑ **Actual (Ea)**	7 in (180 mm)	16°
❑ **Unbalanced (Eu)**	5 in (125 mm)	5°
Grades		
❑ **Desirable Maximum**	3.5%	NA
❑ **Absolute Maximum**	5.0%	10.0%
Minimum Vertical Radius Crest Curve (at top speed)	157,500 ft @ 220 mph (48,000 m @ 350 km/h)	205,700 ft @ 240 mph (62,700 m @ 385 km/h)
Minimum Vertical Radius Sag Curve (at top speed)	105,000 ft @ 220 mph (32,000 m @ 350 km/h)	137,100 ft @ 240 mph (41,800 m @ 385 km/h)
Horizontal Clearance (centerline of track to face of fixed object)	10 ft 4 in @ 220 mph (3.1 m @ 350 km/h)	9 ft 5 in @ 240 mph (2.8 m @ 385 km/h)
Vertical Clearance (top of rail to face of fixed object)	21 ft (6.4 m)	12 ft 2 in (3.7 m)
Track Centerline Spacing	15 ft 8 in @ 220 mph (4.7 m @ 350 km/h)	15 ft 9 in @ 240 mph (4.8 m @ 385 km/h)
Minimum Right-of-Way Requirements		
At-Grade/Cut-and-Fill/Retained Fill	50 ft (15.2 m)	47 ft (14.3 m)
Aerial Structure	50 ft (15.2 m)	49 ft (15 m)
Tunnel (Double Track)	67 ft (20.4 m)	67 ft (20.4 m)
Tunnel (Twin Single Track)	120 ft (36.6 m)	120 ft (36.6 m)
Trench/Box Section	70 ft (21.3 m)	73 ft (22.2 m)
Minimum Station Platform Length	1,300 ft (400 m)	1,300 ft (400 m)
Minimum Station Platform Width	30 ft (9 m)	30 ft (9 m)

Notes: 1- Top Speed Defined in Federal Maglev Deployment Plan
2- Transrapid USA, 1998.
3- mph/s – miles per hour-second
4- km/h/s – kilometers per hour-second

Based on the minimum requirements listed in Table 2.1-1, three general right-of-way parameters were utilized for the screening evaluation: (1) a minimum right-of-way corridor of 50 feet (15.2 meters) was assumed in congested corridors; (2) a 100-foot (30.4-meter) corridor was assumed in less developed areas to allow for drainage, future expansion and maintenance needs; and (3) a wider corridor was assumed in variable terrain to allow for cut and fill slopes and tunnels.

The overall operations strategy and conceptual service parameters that were assumed for high-speed train service in California are documented in Task 1.5.2. Specific scheduling and operations modeling analysis is currently underway and will be used in future detailed engineering and environmental analyses in the next phase of this study.

2.1.2 LOSSAN Corridor Parameter/Assumption Variances

Of the five corridors being studied by the Authority, the Los Angeles – Orange County – San Diego corridor is unique in that it contains, from end to end, an existing intercity passenger rail corridor – the Los Angeles to San Diego (LOSSAN) corridor. In terms of passenger volumes, the LOSSAN corridor is Amtrak's second-busiest corridor in the nation, after the Northeast Corridor connecting Washington, D.C. to New York City. It is used by Amtrak for the State-supported Pacific Surfliner Service between Los Angeles and San Diego, by the Southern California Regional Rail Authority for its Metrolink commuter rail service in Los Angeles and Orange Counties, and in San Diego County by the North County Transit District for its Coaster commuter rail service. Burlington Northern Santa Fe also uses the corridor for freight service.

The presence of the LOSSAN corridor provides an excellent opportunity, as it raises the possibility of building a high-speed train system by incrementally improving an existing service, including the possibility of using conventional fossil-fuel trains rather than electrically powered steel-wheel-on-steel-rail or Maglev technologies. Therefore, in addition to considering alignment options, this study examines two levels of incremental improvements to the LOSSAN corridor that would support different levels of high-speed service, as alternative high-speed train "build" options.

However, the corridor also poses some considerable constraints. It passes through one of the most densely populated areas of the State and, in southern Orange County and San Diego County, traverses ecologically sensitive coastal areas. Due to these significant environmental and community constraints, the LOSSAN options would not be dedicated services. The options either require high-speed trains to share tracks with existing Amtrak, commuter rail and freight service, or would be a separate "feeder" service that would require a transfer to the rest of the high-speed network, at LA Union Station or in Orange County.

A. HIGH-SPEED TRAIN TECHNOLOGIES

Due to significant constraints within this corridor, the alternatives proposed for study are restricted largely to existing transportation corridors – freeways and rail lines. In addition, within the LOSSAN corridor itself, options are being examined that would allow high-speed trains to share tracks with existing Amtrak, commuter rail, and freight services. The intent is not to mix high-speed trains traveling at more than 200 mph (320 km/h) with other rail traffic; in urban areas, the speeds of high-speed trains would be approximately the same as other passenger services. However, by sharing tracks, the intent is to minimize community and environmental impacts while allowing travelers easy access the statewide system.

Given the variety of system configuration options outlined on the previous pages, several different High-Speed (HS) and Very High-Speed (VHS) train technologies were modeled in this corridor. Both electric and fossil-fueled high-speed trains were modeled.

The electric locomotive, the Alstom AEM-7, is currently used in Amtrak's Acela Regional Service (not to be confused with the newer Bombardier vehicle in Acela Express service). This locomotive is capable of accelerating quickly to 125 mph (200km/h). The model in these simulation studies was based on an eight-car train set (two power cars and six passenger cars). This locomotive complies with the Federal Railroad Administration's (FRA) high Crash Energy Management (CEM) requirements and is suitable for shared-use with freight and other passenger service.

The diesel-turbine version of Bombardier's Acela HS locomotive is not yet in revenue service. This locomotive is currently under FRA testing at Pueblo, Colorado test track. It is capable of accelerating to top speeds in the 125-150 mph (200-240km/h) range and has been designed to meet FRA CEM requirements. Fossil fuel locomotives typically have slower acceleration rates than electric vehicles. This technology may be marginally slower than the AEM-7, but travel times will be comparable.

The electric German InterCity Express, commonly known as the ICE 3, was used to model VHS Trains in this corridor. This newer technology has several years of proven service. Instead of separate power cars and passenger cars, power is distributed among all the cars in each consist. The ICE 3 is capable of a top speed of 186 mph (300km/h), and has good acceleration abilities. However, this vehicle is not in service in the U.S., and does not conform to FRA CEM requirements. Reconfiguring the ICE 3 to meet these requirements is likely to add a considerable amount of weight and thus impair acceleration. The model in these simulation studies was consistent with the HS model, and was based on an eight-car train.

B. SYSTEM CONFIGURATION OPTIONS (LOSSAN CORRIDOR)

As studied in this report, the range of LOSSAN options are bracketed by the following two representative configurations:

1. LOSSAN Configuration A - Upgrade the existing LOSSAN corridor with full double-tracking and partial grade-separation to allow rail services to operate at up to 125 mph (200 km/h). All existing Amtrak stations would continue to be served by both existing and high-speed trains. This option assumes a conventional fossil-fuel train system that would not be compatible with the rest of the statewide network. This would require passengers to transfer to and from the rest of the statewide train system at LA Union Station in Los Angeles. Within this screening evaluation, this configuration is represented by alignment options B1a, C1a, and D1a.

2. LOSSAN Configuration B - Upgrade the LOSSAN corridor to full high-speed train standards, including complete grade separation, to permit rail services to travel over 125 mph (200 km/h) in some areas, and allow through-running of trains from other parts of the statewide system. High-speed trains would serve only designated stations, with bypass tracks provided where feasible at all stations including existing Amtrak and commuter rail stations to facilitate express operations. Due to the existing geometry of the LOSSAN corridor, and requirement for shared-use, speeds will not be as high as proposed for other segments of the statewide network. This configuration includes alignment options B1b, C1b, and D1b, and represents the highest level of capital improvements studied for an electrified, fully grade-separated system. The physical upgrades embodied in this option can occur with or without electrification. Without electrification, the "b" option encompasses the highest level of capital improvements studied with a conventional fossil-fueled system.

For the sake of simplicity the LOSSAN "a" and "b" options are discussed throughout this report as two distinct options. However, they should be seen as two bookends in what is in fact a continuous spectrum of design options. By drawing selectively from different elements of "a" and "b" in different parts of the corridor, it would be possible to configure a large number of distinct options between the two extremes discussed in this report.

Basic characteristics of the two LOSSAN configurations are summarized in Table 2.1-2, on the following page. Neither of the shared-use configurations is compatible with the maglev technology.

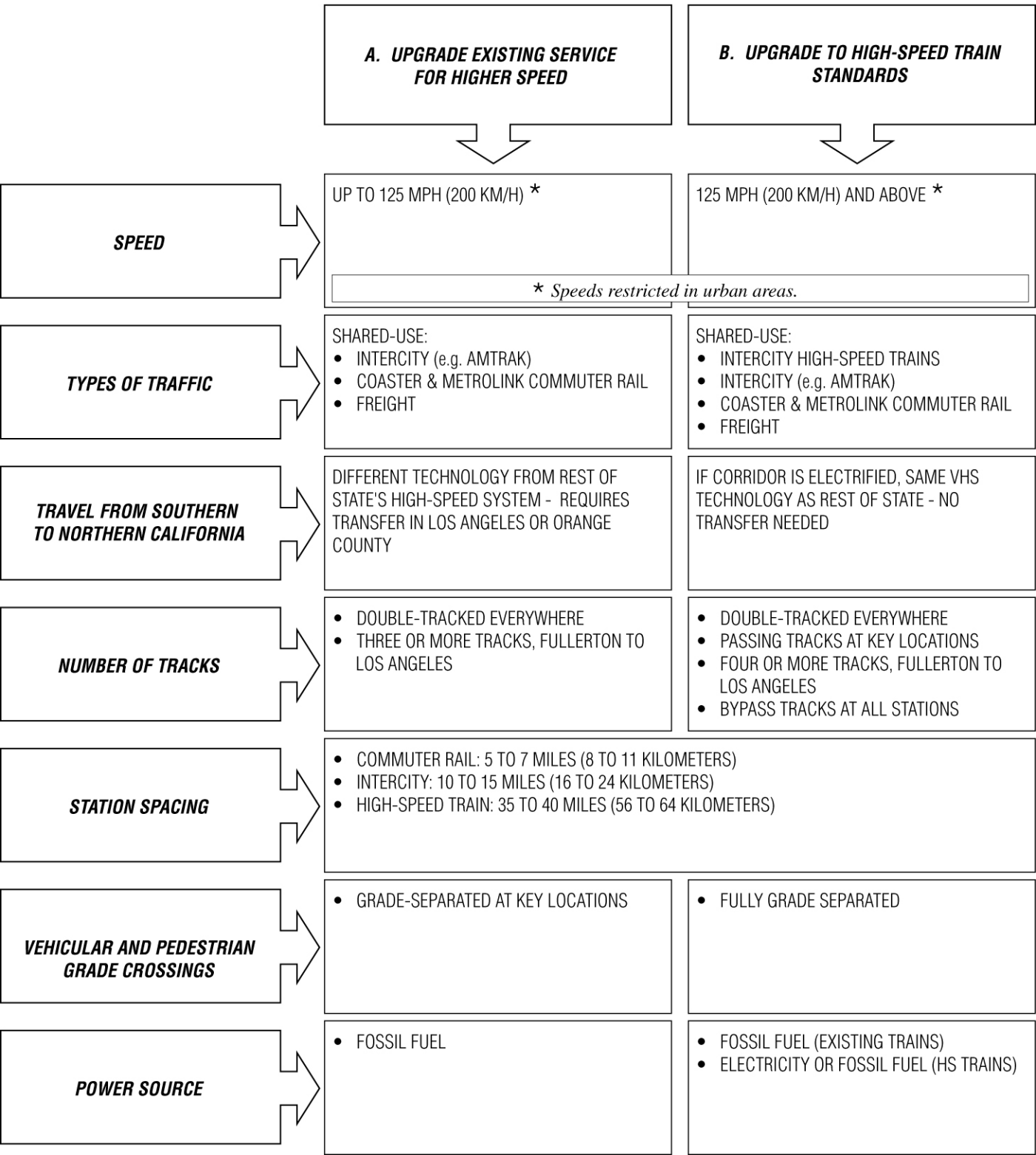
C. LOSSAN CORRIDOR DESIGN VARIANCES

In addition to the parameters in Table 2.1-2, the following variances applied to alignment options in the LOSSAN Corridor:

- Given the shared-use nature of the corridor, grades were limited to 2.5 percent or less, in order to accommodate freight trains.
- Station platforms at LA Union Station, Norwalk, Anaheim, Irvine, Oceanside, University Towne Centre (UTC), and San Diego follow the design parameters in table 2.1-1. The platforms at Solana Beach would be lengthened from existing (if possible) under alignment Option D1b. Station platforms at other Amtrak, Metrolink, and Coaster stations would remain at their current length. At stations where the alignment is grade-separated by the option, vertical circulation to new platforms was assumed.

Table 2.1-2

LOSSAN Shared-Use Improvement Configurations



2.2 EVALUATION METHODOLOGY

As listed in Table 2.2-1, a number of key evaluation objectives and criteria were developed based on previous studies with enhancements that reflect the Authority's high-speed train performance goals and criteria described in Task 1.5.2. These objectives and criteria have been applied in the screening of high-speed train alignment and station options developed as part of this process. Each of the evaluation criteria is discussed in Chapter 4.0, Alignment and Station Evaluation.

Except where noted in the following sections, the engineering and environmental methodologies and assumptions used in evaluating the high-speed train alignment and station options are described in detail in Task 1.5.2.

Table 2.2-1
High-Speed Rail Alignment / Station Evaluation Objectives and Criteria

OBJECTIVE	CRITERIA
Maximize Ridership/Revenue Potential	▪ Travel Time ▪ Length ▪ Population & Employment Catchment
Maximize Connectivity and Accessibility	▪ Intermodal Connections
Minimize Operating and Capital Costs	▪ Length ▪ Operational Issues ▪ Construction Issues ▪ Capital Cost ▪ Right-of-Way Issues/Cost
Maximize Compatibility with Existing and Planned Development	▪ Land Use Compatibility and Conflicts ▪ Visual Quality Impacts
Minimize Impacts to Natural Resources	▪ Water Resources ▪ Floodplain Impacts ▪ Threatened & Endangered Species Impacts
Minimize Impacts to Social and Economic Resources	▪ Environmental Justice Impacts (Demographics) ▪ Farmland Impacts
Minimize Impacts to Cultural Resources	▪ Cultural Resources Impacts ▪ Parks & Recreation/Wildlife Refuge Impacts
Maximize Avoidance of Areas with Geologic and Soils Constraints	▪ Soils/Slope Constraints ▪ Seismic Constraints
Maximize Avoidance of Areas with Potential Hazardous Materials	▪ Hazardous Materials/Waste Constraints

2.2.1 Engineering Evaluation Criteria

The engineering evaluation criteria focus on cost and travel time as primary indicators of engineering viability and ridership potential. Items such as capital costs and travel times have been quantified for each of the alignment and station options considered. Other engineering criteria such as operational, construction, and right-of-way issues are presented qualitatively.

The evaluation criteria presented are consistent with the criteria applied in the previous corridor evaluation study and are based on accepted engineering practice, the criteria and experiences of other railway and high-speed train systems, and recommendations of VHS and maglev manufacturers.

A. LOS ANGELES TO SAN DIEGO VIA ORANGE COUNTY ENGINEERING METHODOLOGY VARIANCES

Given the special nature of the alternatives within this corridor, different approaches were needed to estimate travel times and capital costs. Travel time simulations were conducted to determine the achievable speeds and travel times within the existing rail and freeway corridors that make up the alignment options. The capital costs had to be adjusted for alternatives within the LOSSAN corridor because the alignment options involve a mix of new construction and

upgrades to existing tracks, stations, bridges, and other railway facilities. The following sections described the methodology variances used for this corridor.

Travel Time Simulations

As noted in Section 2.1, several different HS and VHS train technologies were modeled in this corridor, including diesel and electric HS trains and electric VHS trains. Travel time estimates are included in Appendix A.

A proprietary LEGENDS© train simulation model was used to analyze both alignment and technologies to account for the significant restrictions on many of the available corridors on maximum cruise speeds. The use of this model was based on available horizontal tangent and curve information for each of the four alignment alternatives. Use of this model captured the impacts of tight existing curves that will not permit "typical cruise speeds" characteristic of the HS and VHS technology. The ability to negotiate tight curves is the most significant limiting element in higher speed train technology performance. The simulated travel times provide a realistic representation of speeds and indicate the merit of higher speed technologies on each alignment and the corridor as a whole.

Basic Modeling Parameters: In the train simulation modeling, several parameters had to be set that influence vehicle speed through the alignments:

- Acceleration limits (based on passenger comfort, acceleration, braking, and lateral acceleration limits)
- Superelevation
- Station Dwell time

The lateral acceleration and super elevation are functions of curve radius and will restrict the speed of the train before the curve, require slower speeds through the curve, and allow for acceleration coming out of the curve. These parameters were uniformly defined in the simulation model for the curves in each alignment. The acceleration, braking and lateral acceleration limits were set to 3.22 feet/second² (0.98 m/s^2, or 0.1 G) to allow passengers to freely stand and walk about the cabin. Higher acceleration levels would require passengers to remain seated when the train is either accelerating or decelerating. A 10-percent superelevation curve limit was applied to all curves in the alignment alternatives in the simulation model, and speeds in the curves were limited on this basis. However, HS trains can travel at higher speeds when on higher super elevated banks.

The additional parameters that influence train speed in the model include station dwell times, top speeds, and grade climbing ability. The simulation model added two minutes of "dwell" time at each station along the alignment, consistent with the overall methodology. This time is independent of acceleration and deceleration. Top speeds were limited to 125 mph (200 km/h) for HS trains and 186 mph (~300 km/h) for VHS trains. These limits reflect the performance of vehicles currently in service. The simulation model has not yet incorporated any grade assumptions in any of the alignments because no data was available. However, the HS and VHS technologies are designed for 3.5 percent grade capability with minimal speed loss. Most technologies are capable of climbing a five percent grade with considerable vehicle slowing. If the alignments traverse grades greater than 3.5 percent, trip times should be recalculated.

These limits combine to restrict vehicle speeds. The maximum lateral acceleration and superelevation set the speed limits through curves, which are a function of curve radius. These limits force the trains to slow down before many of the curves, and then accelerate after the curves. Some examples of curve speed limits are:

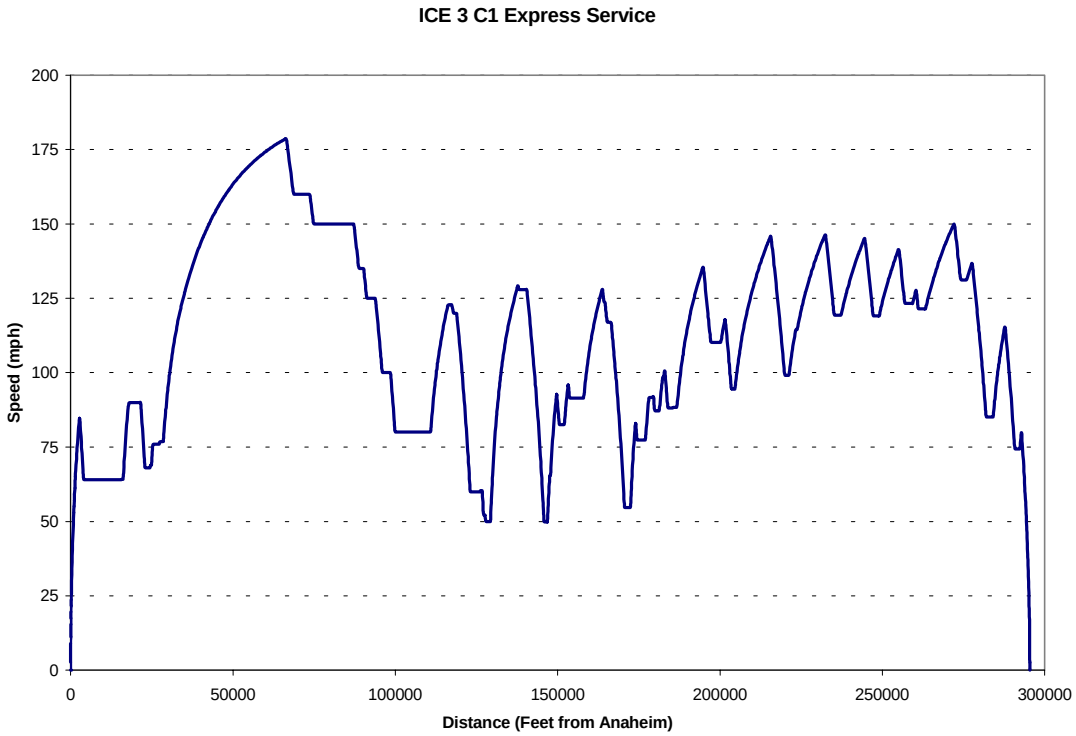
Curve Radius (ft)	Curve Radius (m)	Speed (mph)	Speed (km/h)
1,000	305	55	89
3,000	914	95	153
5,000	1,524	122	196
10,000	3,048	173	278

General Modeling Results: The VHS trip times were obviously shorter than the HS trip times. However, the differences are small due to the alignment curves. Many curves of relatively short radii in these alignments prevent VHS technology from fully utilizing its speed advantage. There are few segments in the alignment where the ICE 3 can remain above 125 mph (200 km/h) for any length of time.

The simulation results verify that allowable curve speeds are the greatest factor in limiting train speed. Curve radii below 10,000 feet (3,125 meters) limit speeds to less than 173 mph (~300 km/h). Most of the curves on the alignment options discussed in this report are well below 10,000 feet (3,125 meters). Hence, there would be very few spans where the VHS top speed of 186 mph (~300 km/h) would be achieved. The simulated trip times of the VHS trains did not significantly outperform the simulated trip times of the HS trains due to the alignment curves. VHS trip times were approximately only five percent lower than HS trip times in all but one section of track in each alignment.

The following speed profile of a VHS train running non-stop from Anaheim to Oceanside on the C1 alignment provides an example of how curves impose speed limitations. The graph shows the speed restrictions in the 50-60 mph (80-96 km/h) range and in the 100-125 mph (160-200 km/h) range that prevent the train from accelerating and holding the top speeds near 186 mph (~300 km/h). The train spends much of the distance restricted below 125 mph (~200 km/h), and nearly all of the distance is restricted below 150 mph (240 km/h). In most of the alignment, there is very little difference between the performance of the VHS locomotive capable of 186 mph (~300 km/h) and the HS locomotive capable of 125 mph (200 km/h). In the few areas where the VHS locomotive reaches top speed, the overall travel times are only five percent shorter than the HS locomotive travel times.

Figure 2.2-1
Simulated Very High-Speed Train Performance on the C1 Alignment



Capital Cost Assumptions

For comparative purposes, capital cost estimates were prepared for the full set of alignment options. Given the preliminary nature of this screening evaluation, specific results have not been published.

LOSSAN Corridor Configurations A and B: The implementation of conventional HS (e.g. Acela) or VHS trains in a shared-use LOSSAN corridor requires some deviation from the standard cost estimating procedure defined in Task 1.5.2 (Screening Methodology).

The No Build condition in the LOSSAN corridor includes a mix of single-, double- and triple-tracked segments. This affects the estimation of quantities and capital costs for the HS and VHS train options corresponding to LOSSAN configurations A and B respectively. This section outlines the modified cost assumptions for the LOSSAN corridor. Certain cost modifications were applied differently to HS and VHS trains.

Track and Guideway: For conventional HS trains (configuration "a"), only new track was considered in the cost estimate. Much of the LOSSAN corridor would require only one new track for configuration "a". Where the alignment is to be re-profiled (tunnel, trench, or aerial), all tracks have been treated as new. VHS trains (configuration "b") would require track and track bed improvements for passenger comfort and equipment maintenance issues throughout the corridor, and all tracks have been treated as new.

The "ballasted track" unit cost (applied to most corridors) is given as $1,257,000 per mile ($781,000 per km) of alignment; this is a double-tracked cost. In areas where a single track is added to the existing corridor for HS trains, this cost would be one half, $628,500 per mile ($392,500 per km).

Likewise, for "direct fixation track", the unit cost is given as $2,376,000 per mile ($1,477,000 per km) of alignment. In areas where adding a single track is proposed for HS trains, this cost would be one half, $1,188,000 per mile ($738,500 per km).

Earthwork and Related Items:

- Earthwork, borrow, and drainage costs are anticipated to be minimal, except where the alignments deviate from the corridor. An average depth of 5 feet (1.5m) of earthwork has been assumed for new alignment and the addition of tracks to the corridor.
- Site preparation and landscaping costs will only be applied to areas of new right-of-way for the alignment, including bypass alignments and corridor widening. (See Right-of-Way)
- Fencing is in place along part of the LOSSAN Corridor, and more would be added for the VHS option (configuration "b") only.

Rail and Utility Relocation: Rail relocation was not assumed. Existing tracks would be used as part of the HS configuration, and replaced in the VHS configuration.

Utility relocation is expected to be less expensive in an existing rail corridor than in new alignments. In general, overhead utilities would already have sufficient clearance, and there would be fewer underground utilities in conflict with an additional track. Therefore, where the No Build track configuration would be retained, no cost for utility relocation has been included. Where a track would being added to the existing corridor, 50 percent of the "new alignment" cost was used. Where the alignment would be new or the profile of the rails is being changed (aerial, trench, or tunnel), the "new alignment" costs were used.

Building Items (Stations): In the LOSSAN Corridor, the proposal would involve extending existing stations (and facilities) or replacing the station. Existing stations represent an opportunity to offset some of the right-of-way, site development, and parking costs. One particular example is the historic Santa Fe Depot in San Diego. The existing station would most likely be expanded to fit the criteria for a terminal station, at less than the full cost of a new station. The costs for expanding existing stations, was assumed to be ten percent lower than new stations.

One of the urban station options (University Towne Centre) would be in a tunnel and have a cost closer to the "terminal" category. In fact, it would be the terminal for some of the dedicated alignments proposed in the Los Angeles to San Diego via Inland Empire corridor of the statewide system. As an order of magnitude estimate, it was assumed that the Terminal Station costs for this location would be used.

One of the operational scenarios features "local" high-speed train service stopping at Fullerton, Santa Ana, San Juan Capistrano, and Solana Beach, in addition to the stops in the *Business Plan*.[12] These additional stops maintain Amtrak service patterns. The standard (Task 1.5.2) costs for major stations from the *Business Plan* (Norwalk, Anaheim, Irvine, Oceanside) and estimates in *Amtrak's California Passenger Rail System 20-Year Improvement Plan*[13] for the other stops (except very short-term funded improvements, within No Build) were used.

Where the alignment is grade-separated (e.g., tunnel or trench) at other Amtrak, Metrolink, or Coaster stations, new platforms, stairs, and elevators are assumed. An allowance of $5 million lump sum (including contingencies) has been made for each affected location.

[12] California High Speed Rail Authority. *Building a High Speed Train System for California, Final Business Plan*. June 2000.
[13] Parsons Brinckerhoff. *California Passenger Rail System 20-Year Improvement Plan*. Prepared for Amtrak, March 2001

Structures/Tunnels/Walls: In this corridor, these items apply where the alignment deviates from the existing LOSSAN corridor, and where grade-separation of the existing alignment is included in the configuration.

- Soundwalls have been included only where widening of the existing corridor is proposed in proximity to noise sensitive land uses.
- Crash walls generally do not apply for this corridor, as shared use is assumed in this rail corridor.

Grade-Separations - LOSSAN: The LOSSAN corridor includes numerous existing grade-separations and grade crossings. The following assumptions were applied:

- For the VHS train configuration ("b"), existing grade crossings would all be grade-separated (either over or under, depending on the proximity of nearby buildings and obstacles).
- The HS and VHS train options include tunnels, trenches, and aerial sections. Grade separation of roads is assumed in these sections. However, where an existing grade-separation is in conflict with the proposed LOSSAN configuration, the cost of a new grade-separation has been assumed. (e.g., an existing undercrossing is replaced by an overcrossing where a trench is proposed.)
- For the HS train configuration ("a"), full grade-separation is not strictly required and only arterial grade crossings have been considered. Other crossings will remain at-grade with protection. All remaining grade crossings are assumed to require quad-gate systems at $400,000 per location.
- Existing road and waterway crossings have not been included in the costs, where the No Build track configuration is sufficient for the HS and VHS configuration.
- Existing single-track waterway crossings and road undercrossings (mostly in southern Orange County and in San Diego County) would be replaced by new (double-track) crossings.
- Existing overcrossings (usually at I-5) would require widening where a track is being added to LOSSAN. Overcrossings modified to add one track are assumed to be 75 percent of the new (double-tracked) cost. The addition of two tracks, at several locations in Los Angeles County, would be 100 percent.
- Where a fourth track is being added, it is assumed that undercrossing and waterway crossing costs are 75 percent of the new (double-tracked) costs.
- At two locations, secondary water crossings are in conflict with trench/tunnel sections of the alignment. An allowance of $5 million (in addition to the standard crossing cost) has been included to rebuild the crossings.

Right-of-Way: Within the existing LOSSAN corridor, there is already rail right-of-way and at least one track. The basic assumption for double-tracked sections is 50 feet (15.6 meters) in urban or suburban areas. The addition of a second track would require 15 to 25 feet (4.7 to 7.8 meters) of additional right-of-way, or 20 feet (6.3 meters) on average. Therefore, where an existing corridor is being widened by one track, 20 feet (6.3 meters) of new right-of-way at 40 percent of the cost of a 50-foot wide strip of land was assumed.

Bypasses and other alignments include new right-of-way: 50 feet (15.6 meters) wide in urban areas, and up to 100 feet (31.3 meters) where available.

Signals and Communication: Where the existing LOSSAN corridor has a sufficient number of tracks (from two to four) in the No Build condition, it is assumed that the HS configuration would not require new signals and communications. All alignment segments (existing or new) where one or more tracks are added would require new signals. The VHS option is assumed to require new signals and communications.

Wayside protection systems are assumed for all alignment segments where the track configuration or profile would be changed or new, and everywhere for VHS.

Electrification: The HS configuration assumes conventional diesel power, and therefore no electrification. VHS includes electrification of the entire alignment.

Special Rail Corridor Projects: Other stakeholders in the LOSSAN corridor, including Amtrak, Caltrans Rail Division, Southern California Regional Rail Authority (SCRRA), and North County Transit District (NCTD), have identified projects to improve passenger rail service in the LOSSAN corridor. Some of these projects are nearing completion or have funding and are considered as part of the No Build alternative. Other projects have been included in the two generic LOSSAN corridor configurations (upgrade to HS, upgrade to HS with VHS path).

For more complex projects, available cost estimates are incorporated where appropriate. Projects of this type include the flyover at Hobart Yard, east of Redondo Junction near downtown Los Angeles.

Capital Cost Assumptions (MTA Green Line Extensions [Option A5])

Typical unit rates for light rail transit (LRT) construction were used to estimate the cost of the elevated light rail extensions to provide a connection from Norwalk to Los Angeles International Airport (LAX).

Capital Cost Assumptions (Other Corridors)

The unit rates from Appendix C of Task 1.5.2 have been used, except for portions of the other alignments (e.g., Options B3, B4) within the LOSSAN corridor.

2.2.2 Environmental Evaluation Criteria

The objectives related to the environment and the criteria used for evaluation are consistent with NEPA and CEQA. The environmental constraints and impacts criteria focus on environmental issues that can affect the location or selection of alignments and stations.

To identify potential impacts for the alignments and station locations, a number of readily available resource agency-approved Geographic Information System (GIS)-compatible digital data sources were used along with published information from federal, state, regional, and local planning documents and reports. For evaluation of alignments and stations, right-of-way widths dictated by engineering requirements were utilized to identify the amount of area within each segment containing certain characteristics. Some environmental issues required using various buffer widths that extended beyond the conceptual right-of-way for the segments. Where noted in section 4.0, field reconnaissance was required to view on-the-ground conditions and to provide relative values of certain resources.

3.0 ALIGNMENT AND STATION DEFINITION

This section briefly describes the alignments and stations for the corridor between Los Angeles and San Diego from previous studies that were re-evaluated, and why some options (either previously studied or new) were screened from further analysis based on previous studies or preliminary evaluation. The rationale is described for additional alignments and stations that have been carried into the screening evaluation (Section 4.0). Finally, all segments and alignment/station options are described, starting in Los Angeles and ending at San Diego.

Given the number of current rail studies in Coastal San Diego County, a comparison matrix was prepared for distribution at public scoping meetings. This matrix is included as Appendix B.

3.1 PREVIOUS ALIGNMENT AND STATION OPTIONS STUDIED

Previous studies and proposals by the California High-Speed Rail Authority and by Amtrak provided important background for the definition of the LOSSAN corridor improvement options.

3.1.1 California High Speed Corridor Evaluation[14]

The feasibility of upgrading the existing LOSSAN corridor for operating VHS trains was previously studied by the Authority as part of the *California High-Speed Rail Corridor Evaluation*. The study looked at the incremental improvement of the existing line to allow for gradually faster trains. This study assumed that until the corridor was capable of VHS traffic, a transfer would have to be made at LA Union Station to connect to the statewide system. The study concluded that operation of VHS trains would eventually be possible within the existing corridor, following years of incremental improvements. Major improvements proposed along this corridor included:

- Run-through tracks at LA Union Station
- Trench/Tunnel in Orange/Santa Ana area
- Short Tunnel segment at San Juan Capistrano
- Tunnel under I-5 around San Clemente
- Tunnel at Encinitas station
- Tunnel under Camino Del Mar, to bypass the bluffs
- Tunnel under University Towne Centre (Miramar Hill)

Potential stations were identified at LA Union Station, Norwalk, Irvine, Oceanside, University Towne Centre and San Diego.

In addition to the Los Angeles-San Diego corridor, a connection from LAX to LA Union Station was looked at, assuming the MTA Harbor Subdivision alignment.

These improvement options and stations have been included in one or both of the LOSSAN improvement configurations in this screening evaluation, and the MTA Harbor Subdivision is one of the alignment options under consideration in the LAX-LA Union Station segment.

[14] Parsons Brinckerhoff. *California High Speed Corridor Evaluation - Environmental Summary.* Prepared for the California High Speed Rail Authority, April 2000.

3.1.2 Amtrak 20-Year Plan[15]

Amtrak issued a 20-year plan in March 2001 for passenger rail improvements in California. These improvements are intended to improve the speed and reliability of passenger service, and provide relief from impacts of the current rail system on sensitive environmental areas and communities. These projects include track and signal work, study of tunnel alignments in conjunction with the Authority and with local rail stakeholders, and station area improvements. Many of the improvements identified as immediate are already underway and fall under the No Build condition for the LOSSAN corridor.

Other proposed improvements, noted by Amtrak as "immediate", "near-term", or "vision" are generally included in one or both of the LOSSAN improvement configurations (Options B1a/b, C1a/b, and D1a/b) for the three affected corridor segments. Examples include various double-tracking projects, the fourth main track from LA to Fullerton, curve realignments at Orange Junction and Dana Point (Pacific Highway), and study of double-tracking through Del Mar.

3.1.3 Relationship of Current LOSSAN Configurations to Previous Studies

Table 3.1-1 summarizes the relationship between the previous studies and current LOSSAN configurations ("a" and "b") being considered in this screening evaluation.

3.2 Confirmation of Reasons Options Screened from Further Analysis

3.2.1 Dedicated High-Speed System in the Coastal Segment of the LOSSAN Corridor

A dedicated very high-speed train system in the LOSSAN corridor was previously studied by the California Intercity High-Speed Rail Commission in 1995 and 1996, and compared with an inland route from Los Angeles to San Diego that would parallel I-10 and I-15 Freeways. The Commission recommended the inland route for a variety of reasons, including significant economic and population growth in the Inland Empire and broad public support from affected cities.

The Commission concluded that the LOSSAN corridor would be better suited for incremental improvements to conventional rail service rather than a dedicated corridor. The Commission held a public review period of its Draft Report and Action Plan in October and November 1996, including a public hearing in Los Angeles on October 29, which was attended by approximately 120 people. Comments at the public meeting touched on the environmental obstacles to implementing high-speed train service along the coastal corridor. Implementing high-speed trains along the LOSSAN corridor was perceived by some speakers as a threat to the conventional intercity (Amtrak) and commuter rail services (Metrolink and Coaster) already using the corridor. Some speakers suggested that incremental improvements such as grade-separations would receive greater political support.

Several written comments were received during the public comment period. These comments identified the following issues:

- The bluffs are narrow in some areas and susceptible to failure, in particular the Del Mar Bluffs. Steel wheels-on-steel rails would cause noise and vibration problems that would be dangerous to the fragile bluffs above the beach.
- The existing right-of-way is narrow and currently divides Encinitas. Additional service in the corridor could restrict access and enjoyment of the beach area to visitors and residents.

[15] Parsons Brinckerhoff. *California Passenger Rail System 20-Year Improvement Plan*. Prepared for Amtrak, March 2001.

Table 3.1-1
Relationship of LOSSAN Corridor Configurations with Previous Studies - Los Angeles to San Diego

Project / Improvement Option	No Build; committed/ funded projects	Corridor Evaluation (CHSRA/PB) 1999	Upgrade to HS Rail (Shared Use)	Upgrade to HS with path to VHS Rail (Shared Use)	Other Related Studies and Proposed Projects
Segment B. LA Union Station to Central Orange County (Anaheim)					
LOSSAN Corridor Improvements		**Corridor Evaluation**	**Configuration "a"**	**Configuration "b"**	
LA to Fullerton:					
Through Service (run-through tracks) at LA Union Station	No Build (Partial Funding)	•	•	•	Corridor Evaluation (CHSRA) Amtrak 20-Year Plan (PS-05) Caltrans Intercity Rail Cap. Prog.
3rd main track; Redondo-Hobart			•		
Hobart Yard Flyover with 3rd/4th main track				•	Amtrak 20-Year Plan (PS-38)
3rd main track; Commerce to Basta	No Build		o	o	Amtrak 20-Year Plan (PS-06) Caltrans Intercity Rail Cap. Prog.
4th main track, Hobart - Commerce			•	•	Amtrak 20-Year Plan (PS-39)
4th main track, Commerce - Fullerton				•	Amtrak 20-Year Plan (PS-07) Caltrans Intercity Rail Cap. Prog. (study funds)
Complete Grade-separation, Electrification		•		•	Corridor Evaluation (CHSRA)
South of Fullerton:					
Complete Grade-separation, Electrification		•		•	Corridor Evaluation (CHSRA) (refers to Orange County Branch)

o Project is included in No Build Alternative, and supports the improvement concept.

• Project is part of the improvement concept

(PS-nn) Project numbers for Amtrak's Pacific Surfliner corridor, from the 20-Year Rail Improvement Plan (March 2001).

Relationship of LOSSAN Corridor Configurations with Previous Studies - Los Angeles to San Diego (cont'd)

Project / Improvement Option	No Build; committed/ funded projects	Corridor Evaluation (CHSRA/PB) 1999	Upgrade to HS Rail (Shared Use)	Upgrade to HS with path to VHS Rail (Shared Use)	Other Related Studies and Proposed Projects
Segment C. Central Orange County (Anaheim) to Oceanside					
LOSSAN Corridor Improvements		**CHSRA/PB 1999**	**a**	**b**	
Orange Junction Curve					
Trench/tunnel existing alignment		•	•		Corridor Evaluation (CHSRA)
Increase curve to 90 mph (145 km/h) and tunnel				•	Amtrak 20-Year Plan (PS-61, without tunnel)
Santa Ana Double Track CP La Veta - CP Lincoln (17th St.)	No Build		o	o	DEIR (2001), SCRRA/Metrolink Caltrans Intercity Rail Cap. Prog.
Grade separation				•	
Santa Ana Station Vicinity					
At-grade, w/ station improvements		•	•		Amtrak 20-Year Plan (PS-08)
Grade separation of streets				•	
Irvine Station - siding/platform	Funded by Caltrans		o	o	Amtrak 20-Year Plan (PS-09) Caltrans Intercity Rail Capital Program
San Juan Capistrano (SJC)					
Double track, Avery - SJC			•	•	Amtrak 20-Year Plan (PS-41)
Double-track at-grade; shift station away from tracks					Amtrak 20-Year Plan (PS-62)
Depressed (tunnel) at SJC station		•	•		Corridor Evaluation (CHSRA)
Bypass tunnel under I-5				•	

Dana Point					
Existing Alignment, complete 2nd main track		•	•		SCRRA/Metrolink project (current)
Curve realignment and short tunnel				•	Amtrak 20-Year Plan (PS-42, without tunnel)
San Clemente					
2nd main track (w. of Camino Real)			•	•	Amtrak 20-year (PS-43)
2 main tracks, grade-separated along beach/bluffs			•		Amtrak 20-year (PS-63, viaduct)
2nd main track, San Clemente/CP Songs (San Onofre)			•		Amtrak 20-year (PS-64)
I-5 tunnel bypass, Pico-San Onofre		•		•	Corridor Evaluation (CHSRA)

o Project is included in No Build Alternative, and supports the improvement concept.

• Project is part of the improvement concept

(PS-nn) Project numbers for Amtrak's Pacific Surfliner corridor, from the 2o-Year Rail Improvement Plan (March 2001).

Relationship of LOSSAN Corridor Configurations with Previous Studies - Los Angeles to San Diego (cont'd)

Project / Improvement Option	No Build; committed/ funded projects	Corridor Evaluation (CHSRA/PB) 1999	Upgrade to HS Rail (Shared Use)	Upgrade to HS with path to VHS Rail (Shared Use)	Other Related Studies and Proposed Projects
Segment C (cont'd). Anaheim-Oceanside (San Diego County portion)		**CHSRA/PB 1999**	**a**	**b**	
San Onofre/Pendleton					
San Onofre-Pulgas, Flores-O'Neill 2nd main track	Part funded for No Build		o	o	Amtrak 20-Year Plan (PS-10, 11) Caltrans Intercity Rail Cap. Prog.
Santa Margarita River Bridge, 2nd main track (Puller to West Brook)		•	•	•	Amtrak 20-Year Plan (PS-12) NCTD (Project Study Report) Caltrans Intercity Rail Cap. Prog.
East Brook-Shell 2nd Main, including bridge over San Luis Rey		•	•	•	Amtrak 20-Year Plan (PS-13) NCTD (PE+Env Only)
Complete Double-Track (San Mateo to San Onofre, rest of SO-Pulgas)		•	•	•	
Oceanside					
Holding Track and Station Improvement					Amtrak 20-Year Plan (PS-14)
Existing Station with 3rd Track		•	•		
Grade-separation from San Luis Rey into Oceanside				•	

o Project is included in No Build Alternative, and supports the improvement concept.

• Project is part of the improvement concept

(PS-nn) Project numbers for Amtrak's Pacific Surfliner corridor, from the 20-Year Rail Improvement Plan (March 2001).

Relationship of LOSSAN Corridor Configurations with Previous Studies - Los Angeles to San Diego (cont'd)

Project / Improvement Option	No Build; committed / funded projects	Corridor Evaluation (CHSRA/PB) 1999	Upgrade to HS Rail (Shared Use)	Upgrade to HS with path to VHS Rail (Shared Use)	Other Related Studies and Rail Improvement Projects
Segment D. Oceanside to San Diego					
LOSSAN Corridor with Design Options		**Corridor Evaluation**	**Configuration "a"**	**Configuration "b"**	
Oceanside					
At grade, w/ holding track at station		•	•		Amtrak 20-Year Plan (PS-14)
Grade separation				•	
Carlsbad					
At grade, 2nd main track		•			Amtrak 20-Year Plan (PS-45)
2nd main track, with partial grade-separation			•		
2nd main track, with full grade-separation				•	
Encinitas					
2nd main track/passing siding, at-grade *(Ponto to Encinitas to Solana Bch)*			•		Amtrak 20-Year Plan (PS-15,16,17) Caltrans Intercity Rail Cap. Prog.
Grade separation at station		•			Corridor Evaluation (CHSRA)
Complete Grade-separation				•	
Solana Beach					
Solana Beach to Del Mar 2nd main track/San Dieguito Bridge			•	•	Amtrak 20-Year Plan (PS-18) NCTD (PE/Enviro. Study funded for 2001-2002) Caltrans Intercity Rail Cap. Prog.
Del Mar					
Mid-term shoring of single track	No Build		o		NCTD (2001, ongoing) Caltrans Intercity Rail Cap. Prog.

Double-track in corridor			•		NCTD Del Mar Alignment Study (start July 2001)
Tunnel on alignment inland from bluffs; under Camino Del Mar or I-5		•		•	Amtrak 20-Year Plan (PS-65) Corridor Evaluation (CHSRA) NCTD Del Mar Alignment Study (start July 2001)
Miramar Hill					
Double track Sorrento-Miramar	No Build		o		Caltrans Intercity Rail Capital Program
Tunnel under University City/Miramar Mesa, new station at University Towne Centre (UTC)		•	•		Corridor Evaluation (CHSRA) Amtrak 20-Year Plan (PS-66) RTP 2020 (SANDAG)
By-pass tunnel under I-5				•	Partial study by Amtrak
Elvira/Rose Canyon to Airport					
Elvira to False Bay 2nd main track			•	•	Amtrak 20-Year Plan (PS-21) Caltrans Intercity Rail Cap. Prog.
False Bay-Tecolote Creek 2nd main track	No Build		o	o	Caltrans, NCTD/MTDB (2001, current project)
Tecolote Creek to Friar 2nd main track			•	•	Amtrak 20-Year Plan (PS-67)
Grade Sep - Old Town to Washington				•	
Airport to Santa Fe Depot					
Grade crossing protection			•		
Aerial		•			
Below-grade				•	

o Project is included in No Build Alternative, and supports the improvement concept.

• Project is part of the improvement concept

(PS-nn) Project numbers for Amtrak's Pacific Surfliner corridor, from the 20-Year Rail Improvement Plan (March 2001).

Note: Lagoon and river crossings assume a 2-track minimum and for the "a" and "b" configurations. Replacement of 1-track bridges is included.

- To prevent dangerous pedestrian crossings of the tracks, the railroad rights-of-way would be fenced. This would block beach access and concentrate the crossing of pedestrian and vehicle traffic to fewer locations.
- Noise and vibrations from trains would be disruptive to ecologically sensitive coastal areas and lagoons (e.g., San Elijo Lagoon). The salt-water marshes and lagoons are a winter habitat for several sensitive bird species.
- A dedicated right-of-way would require two more tracks at-grade (with fencing) or a double-deck configuration, to accommodate existing rail services and high-speed rail. In Encinitas, there may not be room in the existing right-of-way to add two more tracks at grade, so this could mean a double-deck configuration. The structures and overhead catenaries could block views, creating a negative aesthetic impact on tourism-related businesses and reducing property values adjacent to the corridor.

The development of the Authority's *Business Plan*[16] included an evaluation of corridors[17] and over 200 presentations and workshops throughout the State during 1999. The corridor evaluation assumed that the LOSSAN corridor would be upgraded to provide higher operating speeds but would not be a dedicated high-speed system. Several written comments were received during formulation of the *Business Plan* in 1999. Several cities in Orange County wrote to encourage inclusion of the LOSSAN corridor through Orange County, although the City of Tustin was opposed. Several additional comments were received on the subject of the corridor in San Diego County, reiterating the same themes from the 1996 comments and adding specific references to bluff failures in Encinitas.

3.3 ADDITIONAL ALIGNMENT AND STATION OPTIONS

Aside from the LOSSAN corridor upgrades studied, additional alignments within dedicated rights-of-way for the Los Angeles to San Diego coastal corridor have been identified. In addition, various alignments were studied to see if a high-speed connection between LAX and LA Union Station would be feasible.

Figure 3.3-1 shows the alignment and station options within the study corridor. The alignment and station options are described in Section 3.4. In order to compare the alignment options, the corridor has been divided into four segments. The endpoints of the segments are the stations closest to the points where the alignment options join or cross each other: LAX, LA Union Station, Central Orange County (Anaheim), Oceanside, and San Diego.

[16] California High Speed Rail Authority. *Building a High Speed Train System for California, Final Business Plan.* June 2000.
[17] Parsons Brinckerhoff. *California High-Speed Rail Corridor Evaluation.* Prepared for California High-Speed Rail Authority, December 1999.

June 27, 2001 *California High-Speed Train Program EIR/EIS*

Figure 3.3-1
Proposed Alignment and Station Options

3.3.1 Segment A – LA Union Station/Southeast LA County to LAX

Three alignment options were considered to provide stand-alone or through service from LA Union Station to LAX.

OPTION A1. INTERSTATE 405 AND INTERSTATE 10

Alignment Option A1 uses existing freeway corridors from LA Union Station to LAX. The alignment allows for the possibility of adding a station to serve west Los Angeles communities in the future. This option would be a dedicated high-speed system.

OPTION A2. MTA HARBOR SUBDIVISION

The Harbor Subdivision alternative follows an existing rail alignment for most of the segment from LA Union Station to LAX. The Authority previously studied this.

OPTION A3. INTERSTATE 105 AND INTERSTATE 110

This is a southern freeway alignment alternative for Option A1, for the connection from LA Union Station to LAX. This option would be a dedicated high-speed system.

Two other alternatives were considered, connecting LAX to southeast Los Angeles County instead of LA Union Station:

OPTION A4. UPGRADE MTA GREEN LINE TO SUPPORT HIGH-SPEED TRAIN

This option requires upgrading the existing MTA Green Line to allow for higher speed trains to operate shared-use with light rail.

OPTION A5. MTA GREEN LINE EXTENSION

For this option, an extended Green Line would provide a light rail connection to LAX from a southeast LA County high-speed train station.

3.3.2 Segment B – LA Union Station to Central Orange County (Anaheim)

OPTION B1. LOSSAN CORRIDOR

Option B1a includes a minimum of three main tracks between LA Union Station and Fullerton, while Option B1b includes 4 tracks, to increase capacity and reliability of the rail corridor for high-speed trains and other rail traffic.

In addition to the LOSSAN corridor, three new alignment options were defined for this segment of the Los Angeles to San Diego corridor. All three options are dedicated corridors, to allow the high-speed trains to avoid the heavy freight and commuter rail traffic on the existing LOSSAN corridor from Los Angeles to Fullerton.

OPTION B2. INTERSTATE 5 FREEWAY

This alignment would follow I-5 south of the US-101/I-5/I-10/SR-60 interchange (East LA interchange). This allows for a dedicated bypass of the freight and commuter rail corridor, and a reasonably direct alignment to Central Orange County.

OPTION B3. PACIFIC ELECTRIC RIGHT-OF-WAY

This alignment is a lightly used rail line between Paramount and Stanton, and an abandoned corridor through to Santa Ana. Its long tangent sections could support high-speed train operation.

OPTION B4. UNION PACIFIC SANTA ANA BRANCH LINE

This alternative uses an existing Union Pacific (UP) branch line from southeast LA to Anaheim, where it would connect back to I-5 alignment.

3.3.3 Segment C – Central Orange County (Anaheim) to Oceanside

The alignments studied for this segment are primarily continuations of the alternatives from those described above in section 3.3.2.

OPTION C1. LOSSAN CORRIDOR

There are two options in the LOSSAN corridor. Option C1a includes upgrades within the corridor, including grade-separation at San Juan Capistrano and San Clemente. Option C1b includes upgrades and bypass alignments around the environmentally sensitive coastal communities and regions of south Orange County.

OPTION C2. INTERSTATE 5 FREEWAY

This alignment continues along I-5 in Orange County and continues through Camp Pendleton, providing a dedicated high-speed alignment and bypassing constrained sections of the LOSSAN corridor.

OPTION C3. SAN JOAQUIN CORRIDOR (SR-73) WITH INTERSTATE 5

This is a dedicated alignment option, continuing from the PE right-of-way in Garden Grove. This is a southern highway alternative to Option C2 (which follows I-5 through Santa Ana, Tustin, and Irvine), and passes through some less developed parts of Orange County.

OPTION C4. INTERSTATE 5 AND FOOTHILL CORRIDOR (SR-241)

This alternative would use the right-of-way of the existing and proposed alignments of the SR-241 Toll Road in eastern Orange County. This alignment option would bypass the coastal communities of southern Orange County and join I-5 alignment from San Onofre to Oceanside.

3.3.4 Segment D – Oceanside to San Diego

In San Diego County only two distinct alignments were studied: LOSSAN and I-5. Due to the terrain and pattern of residential development in coastal San Diego County, no other alternatives were determined feasible.

OPTION D1. LOSSAN CORRIDOR

Option D1a includes the tunnel under University Towne Centre (UTC) from the *Corridor Evaluation Study*[18]. Option D1b includes a tunnel under Camino Del Mar, and a more direct tunnel alignment

[18] Parsons Brinckerhoff. *California High-Speed Rail Corridor Evaluation.* Prepared for California High-Speed Rail Authority, December 1999.

under I-5 instead of UTC, to increase speed. A tunnel bypass alignment under I-5 had undergone some preliminary analysis by Amtrak, but no action has been taken since.

OPTION D2. INTERSTATE 5 FREEWAY

This is the only freeway option for a dedicated high-speed alignment along the coast in San Diego, and it allows bypassing of sensitive coastal areas along the LOSSAN corridor.

3.3.5 Other Options Screened from Analysis

A. THE ALAMEDA CORRIDOR

The Authority has not previously studied this alignment.

The Alameda Corridor was briefly considered during this current study as a north-south connecting option between I-105 and LA Union Station in Los Angeles, as part of a LAX - LA Union Station alignment alternative. It was also considered as part of an alignment from LA Union Station to Orange County, paired with the UP Santa Ana Branch line.

The Alameda corridor will experience high densities of freight traffic between the Ports of LA and Long Beach and the Redondo Junction, and will be in a trench alongside Alameda Street. A high-speed passenger train system would have to straddle the freight corridor on a structure above the existing streets, or follow Alameda Street. Either option would run counter to the community planning process that resulted in the decision to build a trench alongside Alameda Street in the first place. Therefore, the Alameda Corridor will not be considered any further.

Instead, the LAX-LA Union Station Option A3 follows I-10 and I-110 to I-105 corridor, and the LA-Orange County Option B4 follows the LOSSAN corridor, and the San Pedro Branch line to reach the UP Santa Ana Branch.

B. I-405 AND/OR HARBOR SUBDIVISION CORRIDOR IN LOS ANGELES AND ORANGE COUNTIES

During the scoping period, some suggestions were received about using I-405 corridor, possibly in connection with the Harbor Subdivision, as an alternative route from south Orange County to LAX. Generally, from Irvine, the alignment would veer away from I-5 or the LOSSAN corridor, following I-405 corridor through coastal Orange County into the South Bay area of Los Angeles County. From here, the alignment would turn northward, continuing to follow I-405 or, alternatively, the Harbor Subdivision, until reaching LAX. From there, suggestions to rejoin the statewide network included turning east toward LA Union Station, or continuing north on I-405 to Santa Clarita.

The advantages cited by proponents of this route included less potential competition with existing rail services in the LOSSAN corridor, and the chance to serve an untapped market in west Orange County and in the South Bay.

This alternative was not considered further in this analysis due to several serious issues. First, the presence of severe right-of-way constraints along most of I-405 between Irvine and LAX would necessitate either extensive tunneling and/or aerial structures.

Second, an I-405 alignment would be closer to the coast and therefore its catchment area would be more one-sided relative to a LOSSAN or I-5 route, which is closer to the population centers in northern Orange County and southeast LA County. The I-405 alignment would bypass the

Gateway Cities of southeast LA, serving the South Bay cities instead. Similarly, north-central Orange County would be bypassed in favor of coastal northern Orange County. Ridership would likely suffer due to the less central location of I-405 alignment.

Given that it is vital to serve LA Union Station, an I-405 alignment would introduce an awkward circuitous "double-back" route between LAX and LA Union Station, adding to both real and perceived travel time, with attendant effects on ridership.

Finally, communities surrounding LAX, including many in the South Bay region would be likely to strongly oppose such an alignment due to fears that it would induce higher demand at LAX, based on conversations with members of the South Bay Council of Governments and other groups opposed to expansion of LAX.

3.4 ALIGNMENT OPTIONS

This section describes the alignment options in each of the four corridor segments, listed in Table 3.4-1.

Shared-use improvement options are being considered only in the LOSSAN corridor, because other corridors would involve construction of new tracks or guideway and thus lend themselves to being dedicated systems.

Under the "Upgrade to High-Speed Train" options (B1a/C1a/D1a), all existing Amtrak stations would continue to be served by both conventional and high-speed trains. Under all other options, high-speed trains would only serve the high-speed train stations

Where feasible, stations would have four tracks: two for trains stopping at the station (this includes commuter rail and multiple-stop intercity service), and two bypass tracks for express services. On the LOSSAN corridor (options B1b/C1b/D1b), this includes proposed VHS stations and other Amtrak, Metrolink, and Coaster stations.

Appendix C contains maps showing the alignments, station locations, and profiles for each option, assumed for costing purposes.

Table 3.4-1
Summary of Los Angeles to San Diego Alignment Options

Segment / Alignment Option		Configuration	Alignment	Profile	Stations
SEGMENT A - LA UNION STATION / SOUTHEAST LA COUNTY TO LAX					
A1	Interstate 405 and Interstate 10	Dedicated VHS/Maglev	Connection to LAX from LA Union Station via I-10 and I-405 corridors.	Grade-separated (Aerial)	• LAX Terminal • LA Union Station
A2	MTA Harbor Subdivision	Dedicated VHS/Maglev	From LAX proceed west along Century Blvd. Follow the MTA Harbor Subdivision north, and the West River Subdivision to LA Union Station at 4th St.	Grade-separated (Aerial or Trench)	• LAX Terminal • LA Union Station
A3	Interstate 105 and Interstate 110	Dedicated VHS/Maglev	Century Blvd. to La Cienega, south to I-105, east to I-110 corridor, north to I-10 east. Follow the East River subdivision north to LA Union Station.	Grade-separated (Aerial)	• LAX Terminal • LA Union Station
A4	Upgrade MTA Green Line to Support High-Speed Train	HS Train, shared-use with LRT System	LAX to I-105 via La Cienega and Century Blvd. Existing Green Line corridor on I-105. Imperial Highway to Norwalk Metrolink.	At-grade; follow existing Green Line; Aerial at east and west extensions	• LAX Terminal • *Intermediate stations served by Green Line* • Norwalk (Option 1) • Paramount (Option 2)
A5	MTA Green Line Extension	Extend LRT System to allow airport transfer	LAX to I-105 via La Cienega and Century Blvd. Follow along the existing Green Line corridor towards Norwalk. Imperial Highway to Norwalk Metrolink.	At-grade; follow existing Green Line; Aerial at east and west extensions	• LAX Terminal • *Intermediate stations served by Green Line* • Norwalk (Option 1) • Paramount (Option 2)
SEGMENT B - LA UNION STATION TO CENTRAL ORANGE COUNTY (ANAHEIM)					
B1a	LOSSAN corridor with 3 Main Tracks to Fullerton	Upgrade to HS (Shared-Use)	Follow San Bernardino and Orange subdivisions south of LA	Existing grade (Predominately at-grade) with numerous grade-separations.	• LA Union Station • Norwalk (LOSSAN) • Fullerton (served by Amtrak) • Anaheim (LOSSAN)
B1b	LOSSAN corridor with 4 Main Tracks to Fullerton	Upgrade to HS with path to VHS	Follow San Bernardino and Orange subdivisions south of LA	Existing LOSSAN profile, at-grade plus flyover at Hobart.	• LA Union Station • Norwalk (LOSSAN) • Anaheim (LOSSAN) • *Bypass tracks at Metrolink/Amtrak stations*

Segment / Alignment Option		Configuration	Alignment	Profile	Stations
B2	Interstate 5 Freeway	Dedicated VHS or Maglev	I-5 to Beach Blvd. Follow UP Santa Ana Branch to Euclid St. Continue between I-5 & Manchester	Aerial from LA Union Station along I-5 to Beach Blvd. At-grade but separated from crossings along UP corridor, from Beach Blvd. to Euclid St., then aerial.	• LA Union Station • Norwalk I-5 (near Imperial Hwy.) • Anaheim I-5 (between Katella & Gene Autry Way)
B3	Pacific Electric Right-of-Way	Dedicated VHS or Maglev	LOSSAN corridor and BNSF San Pedro to Paramount. PE ROW to Garden Grove, then SR-22 east.	Grade-separated; trenched in residential and aerial in industrial; At-grade along the LA River, I-710, & Rio Hondo.	• LA Union Station • Paramount (I-105 at Garfield & Paramount) • Garden Grove (near SR-22)
B4	Union Pacific Santa Ana Branch Line	Dedicated VHS or Maglev	Follow B3 alignment from LA to Cudahy. Follow UP Branch to I-5 at Santa Ana St. (Anaheim) & follow along south side of I-5.	Grade-separated; trenched in residential and aerial in industrial; some at-grade river crossings. Same as B2 from Beach Blvd. south.	• LA Union Station • Norwalk UP (near Imperial Hwy) • Santa Ana I-5 (between Katella & Gene Autry Way)
SEGMENT C - CENTRAL ORANGE COUNTY (ANAHEIM) TO OCEANSIDE					
C1a	LOSSAN Corridor with Upgrades	Upgrade to HS (Shared-Use)	Use existing LOSSAN corridor except for Orange Junction, San Juan Capistrano, and San Clemente. Add second main track from Dana Point to San Onofre.	Existing LOSSAN profile; double-track and tunnel at San Juan Capistrano station area; double-track and grade-separated along coast south of San Clemente Metrolink station.	• Irvine (LOSSAN) • San Juan Capistrano (served by Amtrak) • Oceanside (LOSSAN) • *Bypass tracks at other Metrolink stations*
C1b	LOSSAN Corridor with Full Grade-Separation and Bypasses	Upgrade to HS with path to VHS	Use existing LOSSAN corridor. I-5 bypass in San Juan Capistrano. Link to LOSSAN corridor N. of Dana Point. I-5 bypass in San Clemente. Link back to LOSSAN in San Onofre.	Existing LOSSAN profile, bypass tunnels at San Juan Capistrano and San Clemente.	• Anaheim LOSSAN • Irvine LOSSAN • Oceanside LOSSAN • *Bypass Tracks at other Metrolink Stations*
C2	Interstate 5 Freeway	Dedicated VHS or Maglev	Follow I-5 Corridor through Southern Orange County, continue from options B2 and B3a	Primarily aerial; Tunnel through San Clemente. At-grade in Camp Pendleton. Aerial over I-5 and rivers.	• Irvine I-5 (E. of Jeffrey Rd.) • Oceanside I-5 (Oceanside Blvd.)
C3	San Joaquin Corridor (SR-73) with Interstate 5	Dedicated VHS or Maglev	Continue from B3b Follow PE ROW to S. on Santa Ana River to E. along I-405 to S. along SR-73. I-5 from San Juan Capistrano to Oceanside.	Grade-separated; Trenched on PE ROW, Santa Ana River, and SR-73 S. of John Wayne Airport, aerial along I-405, SR-73 S. of La Paz, and I-5, tunnel through San	• Newport Beach (SR-73 and Jamboree Rd.) • Oceanside I-5 (Oceanside Blvd.)

Segment / Alignment Option		Configuration	Alignment	Profile	Stations
				Joaquin Hills and San Clemente to Christianitos Road.	
C4	Interstate 5 and Foothill Corridor (SR-241)	Dedicated VHS or Maglev	Leave I-5 corridor in Irvine to follow N. SR-133 to S. SR-241. Link back to I-5 at San Onofre.	Grade-separated; Aerial, some tunnel may be necessary in SR-241. Same option as C2 at Oceanside and Camp Pendleton.	• Irvine I-5 (E. of Jeffrey Rd) • Oceanside I-5 (Oceanside Blvd)
SEGMENT D - OCEANSIDE TO SAN DIEGO					
D1a	LOSSAN Corridor with Tunnel at University City	Upgrade to HS	Follow existing LOSSAN corridor. Bypass Miramar Junction via tunnel under University Towne Centre.	Double tracking proposed along LOSSAN corridor. Tunnel under University Towne Centre to bypass Miramar Junction.	• Oceanside (LOSSAN) • Solana Beach (LOSSAN) • University Towne Centre (La Jolla Village Dr. and Genesee Ave) • San Diego Santa Fe Depot • *Bypass Tracks at other Coaster Stations*
D1b	LOSSAN Corridor with Tunnel Under I-5	Upgrade to HS with path to VHS	Follow existing LOSSAN. Bypass Del Mar Bluffs and from Sorrento Valley to Elvira.	Tunnel to bypass Del Mar Bluffs. Second Tunnel under I-5 from Sorrento Valley to Elvira, grade-separated from Oceanside to Del Mar. Bridges over lagoon and river crossings.	• Oceanside (LOSSAN) • Solana Beach (LOSSAN) • San Diego Santa Fe Depot • *Bypass Tracks at other Coaster Stations*
D2	Interstate 5 Freeway	Dedicated VHS or Maglev	Follow I-5 corridor from Oceanside to Washington St. in San Diego.	Grade-separated; Generally aerial.	• Oceanside I-5 (Oceanside Blvd) • Solana Beach I-5 (Lomas Santa Fe Drive) • San Diego Airport (Washington St.)

3.4.1 Segment A – LA Union Station/Southeast LA County to LAX

Figure 3.4-1 shows the alignment and station options considered for this corridor segment.

A1 - INTERSTATE 405 AND INTERSTATE 10

Configuration:

- Dedicated VHS or maglev (compatible with proposed statewide system)

Alignment:
This alternative would link LA Union Station with the LAX via I-10 and I-405 corridors. From LAX, the alignment follows Century Boulevard and I-405 north from LAX to I-10. It would then head east along I-10 to the east side of the Los Angeles River. From this point, the alignment follows the East River Subdivision to 4th Street, and crosses city blocks between the MTA Red Line Maintenance Yard and LA Union Station. This has been assumed for screening purposes but would be changed, if necessary, to match the configuration(s) selected after screening by the Authority.

Profile:

- Grade-separated (aerial)

Stations:

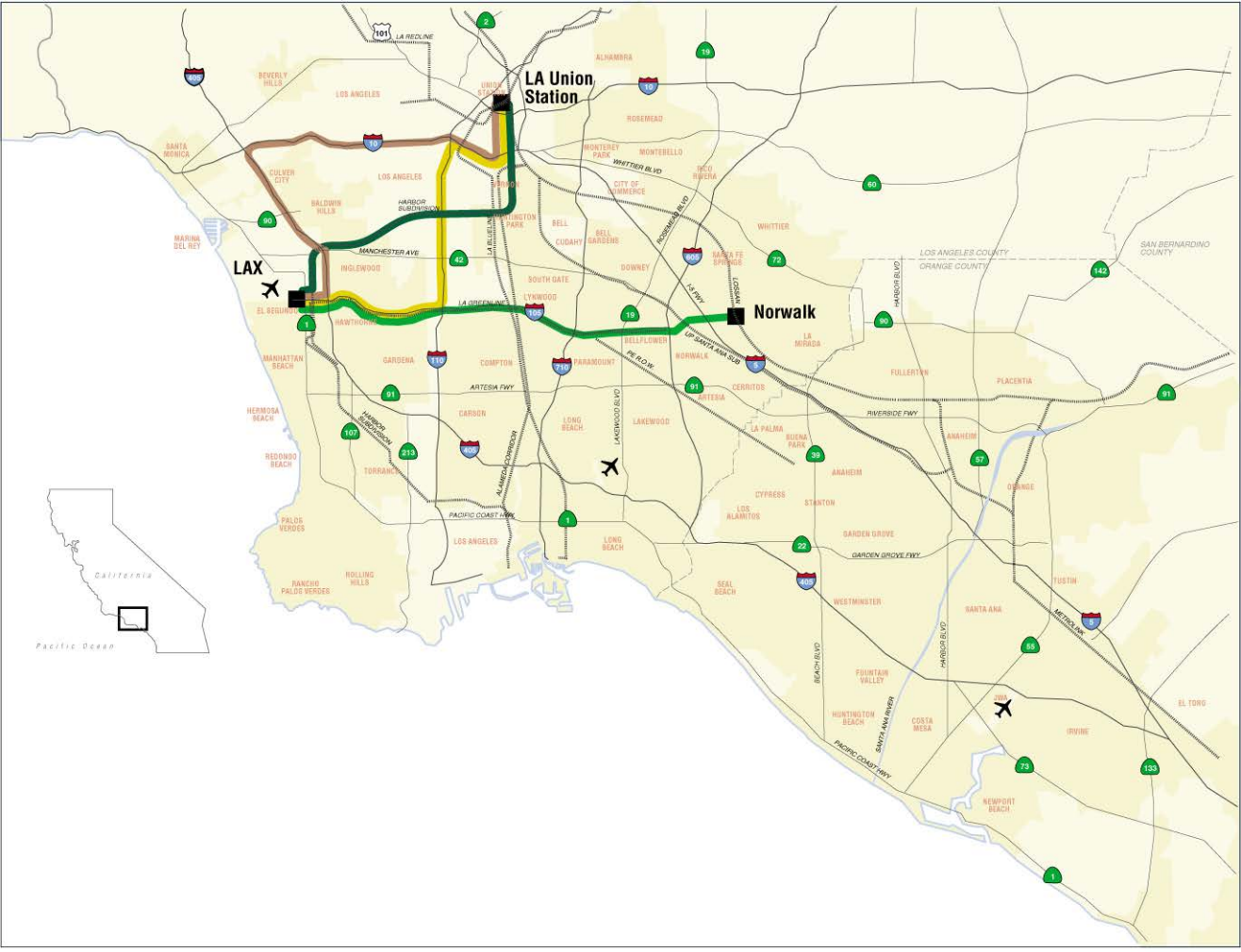
- *LAX Terminal* – This station would be located near Terminal 1 in the Central Terminal Area (CTA) of LAX. It is proposed here to provide as convenient a connection as possible for air passenger travelers to the high-speed train network. On-site airport access is extremely important to enhancing the level of service and attracting ridership to the system.
- *LA Union Station* – LA Union Station functions as a downtown transportation hub for light rail, heavy rail, commuter rail, Amtrak, and bus service. This station would be the existing station with the addition of run-through tracks from the south.

A2 - MTA HARBOR SUBDIVISION

Configuration:

- Dedicated VHS or maglev (compatible with statewide system)

Alignment:
From the LAX Terminal, this alignment follows Century Boulevard west to the MTA Harbor Subdivision. The Harbor Subdivision right-of-way runs roughly parallel to Aviation Boulevard, crosses over I-405 and continues along Florence and Slauson Avenues through south-central Los Angeles. It turns north, running approximately one block east of Santa Fe Street, until Redondo Junction, where it joins the Metrolink right-of-way. From this point, the alignment follows the West River Subdivision to 4th Street, and crosses city blocks between the MTA Red Line Maintenance Yard and LA Union Station.



Source: IBI Group

July 18, 2001

California High-Speed Train Program EIR/EIS

4 0 4 Miles

4 0 4 Kilometers

Legend

- I-405/I-10 (A1)
- MTA HARBOR SUB (A2)
- I-105/I-110 (A3)
- UPGRADE/EXTEND MTA GREENLINE (A4/A5)
- Station

Segment A - LAX to Union Station/ Southeast LA County

Figure 3.4-1

Profile:

- Grade-separated (aerial or trench) – assumes an aerial guideway east of I-110 to clear the intersecting Alameda Corridor trench. Assumes construction of a trench west of I-110 due to abutting residential uses.

Stations:

- LAX Terminal (Refer to description for Option A1)
- LA Union Station (Refer to description for Option A1)

Notes:

- Alignment Option A2 is mostly along the Harbor Subdivision, formerly the Burlington Northern Santa Fe Railroad (BNSF) but now owned by the MTA. This right-of-way includes a single track.
- There is the potential for this right-of-way to be converted to at-grade LRT (MTA) or commuter rail (Metrolink).

A3 – INTERSTATE 105 AND INTERSTATE 110

Configuration:

- Dedicated VHS or maglev (compatible with proposed statewide system)

Alignment:

From the LAX Terminal, this alignment follows Century Boulevard east to La Cienega/I-405, and turns south to I-105. The alignment follows I-105, I-110, and I-10 corridors from the LAX area to Los Angeles. The approach to LA Union Station would be via the East River Subdivision along the LA River and new rail alignment approaching LA Union Station from the south, as described for Options A1 and A2.

Profile:

- Grade-separated (aerial)

Stations:

- LAX Terminal (Refer to description for Option A1)
- LA Union Station (Refer to description for Option A1)

A4 – UPGRADE MTA GREEN LINE TO SUPPORT HIGH-SPEED TRAIN

Configuration:

- Shared-use, upgrade LRT line to accommodate high-speed train sets.

Alignment:

This alignment would require rebuilding/upgrading the MTA Green Line to support a high-speed connection to LAX from Orange and San Diego Counties (in conjunction with Segment B), starting from either Norwalk or Paramount, depending on the route to Orange County. The connection to LAX along I-105 corridor is assumed (for screening analysis) to follow La Cienega and Century Boulevard. With the exception of the Pacific Electric right-of-way option (see B3), connecting tracks from the existing Green Line terminus (I-605/I-105 in Norwalk) to the main north-south high-speed train alignment into LA would be needed. It is assumed that an elevated rail system would follow the median of Imperial Highway.

Profile:

- At-grade in exclusive right-of-way, with some grade-separation. Follow the existing Green Line profile, except at the west and east extensions, which would be on an aerial structure above the existing city streets.

Stations:

- LAX Terminal (Refer to description for Option A1)
- *Intermediate stations currently served by MTA Green Line*
- *Norwalk; Option 1 (Refer to description for Option B1a-b)*
- *Paramount; Option 2 (Refer to description for Option B4)*

Notes:

- A long-term connection to LAX by the Green Line may be planned by MTA, but there is no confirmed alignment.
- MTA does not have plans to extend the Green Line east of I-605.

A5 - MTA GREEN LINE EXTENSION

Configuration:

- Extend/add stations to the Green Line. (No high-speed train service on the Green Line.)

Alignment:

This option considers the possibility of MTA extending the Green Line to the Norwalk Metrolink station, allowing for a connection to the existing Metrolink and Amtrak system. As part of the *LAX Master Plan*[19], an extension of the Green Line into the terminals is also a possibility. This would give a connection from a high-speed train alignment to LAX, with one transfer.

Profile:

- New Alignments: Grade-separated (aerial), as described in A4.
- Existing alignment will remain unchanged.

Stations:

- LAX Terminal (Refer to description for Option A1)
- *Intermediate stations currently served by MTA Green Line*
- *Norwalk; Option 1 (Refer to description for Option B1a-b)*
- *Paramount; Option 2 (Refer to description for Option B4)*

Notes:

- For an extension to Norwalk from I-605, other stations could be Imperial/Firestone or Imperial/Pioneer, Imperial/Norwalk and the Norwalk Metrolink station. This depends on the connecting point to the HS system.

[19] URS Corporation. *Draft LAX Master Plan*. Prepared for Los Angeles World Airports. November 2000.

3.4.2 Segment B – LA Union Station to Central Orange County (Anaheim)

Figure 3.4-2 shows the alignment and station options considered for this segment.

B1 – EXISTING LOSSAN CORRIDOR WITH DESIGN OPTIONS

Configuration:
- Upgrade to HS (B1a)
- Upgrade to HS with path to VHS (B1b)

B1A – LOSSAN CORRIDOR WITH THREE MAIN TRACKS TO FULLERTON

Configuration:
- Upgrade to HS

Alignment:
The alignment follows the San Bernardino and Orange Subdivisions of the LOSSAN corridor south from LA. This alternative would add several incremental improvements to the corridor, including a third main track from Los Angeles to Fullerton.

Profile:
- Existing Profile, predominately at-grade with numerous grade-separated crossings.

Rail Corridor Improvements:
- Amtrak's 20-year improvement plan calls for the extension of the platform tracks at LA Union Station over US-101, then south toward the Los Angeles River. Partial funding is identified in Caltrans' *Intercity Rail Capital Program*[20]. This would allow through service at LA Union Station. An approximate alignment was described under Option A1.
- Add a third main track east of Hobart, resulting in a continuous third main track from Los Angeles to Fullerton.
- Complete segments of a fourth main track, from Hobart to Commerce and Basta to Fullerton Junction, from the Amtrak plan.

Stations:
- *LA Union Station* – See description under Option A1.
- *Norwalk LOSSAN* – This station would be located on the LOSSAN corridor at Imperial Highway, east of Bloomfield Avenue at the border between the cities of Norwalk and Santa Fe Springs in Los Angeles County. An existing Metrolink station is located here along with a park-and-ride lot (Figure 3.4-3).
- *Fullerton station (served by Amtrak)*
- *Anaheim LOSSAN* – This station would be located on the LOSSAN corridor between Katella Avenue and the Santa Ana River Channel (SARC) in Anaheim. An existing Metrolink/Amtrak station is at this location. A potential site also exists east of the existing station, between SR-57 and SARC. Edison International Field is located on the property to the south. (See Figure 3.4-4)

[20] California Department of Transportation (Caltrans). *California Intercity Rail Capital Program.* February 2001.

No Build Conditions:

- The alignment from the Los Angeles River southeast to Fullerton is currently double or triple-tracked and is the main east-west freight line for BNSF. The high density of freight poses an operational challenge. If higher speed trains are to operate on this corridor, the number of tracks must be increased. In the current Amtrak 20-year plan, the corridor from Redondo Junction to Fullerton would be a minimum of three tracks, and four in the longer term.
- The near-term construction in the LOSSAN corridor will add a third main track from Commerce to Basta (which is located at the west end of the City of Fullerton).
- The line south of Fullerton is at-grade, passing through several grade crossings in the cities of Anaheim, Orange, and Santa Ana. There are also several grade crossings in Los Angeles County.

B1B – LOSSAN CORRIDOR WITH FOUR MAIN TRACKS TO FULLERTON

Configuration:

- Upgrade to HS with path to VHS

Alignment:

The alignment follows the San Bernardino and Orange Subdivisions of the LOSSAN corridor south from LA Union Station to Fullerton Junction and Anaheim. This alternative would add several incremental improvements to the corridor providing for high-speed train operations and the potential for very high-speed train in the future.

Profile:

- Existing Profile, plus flyover at Hobart.

Rail Corridor Improvements:

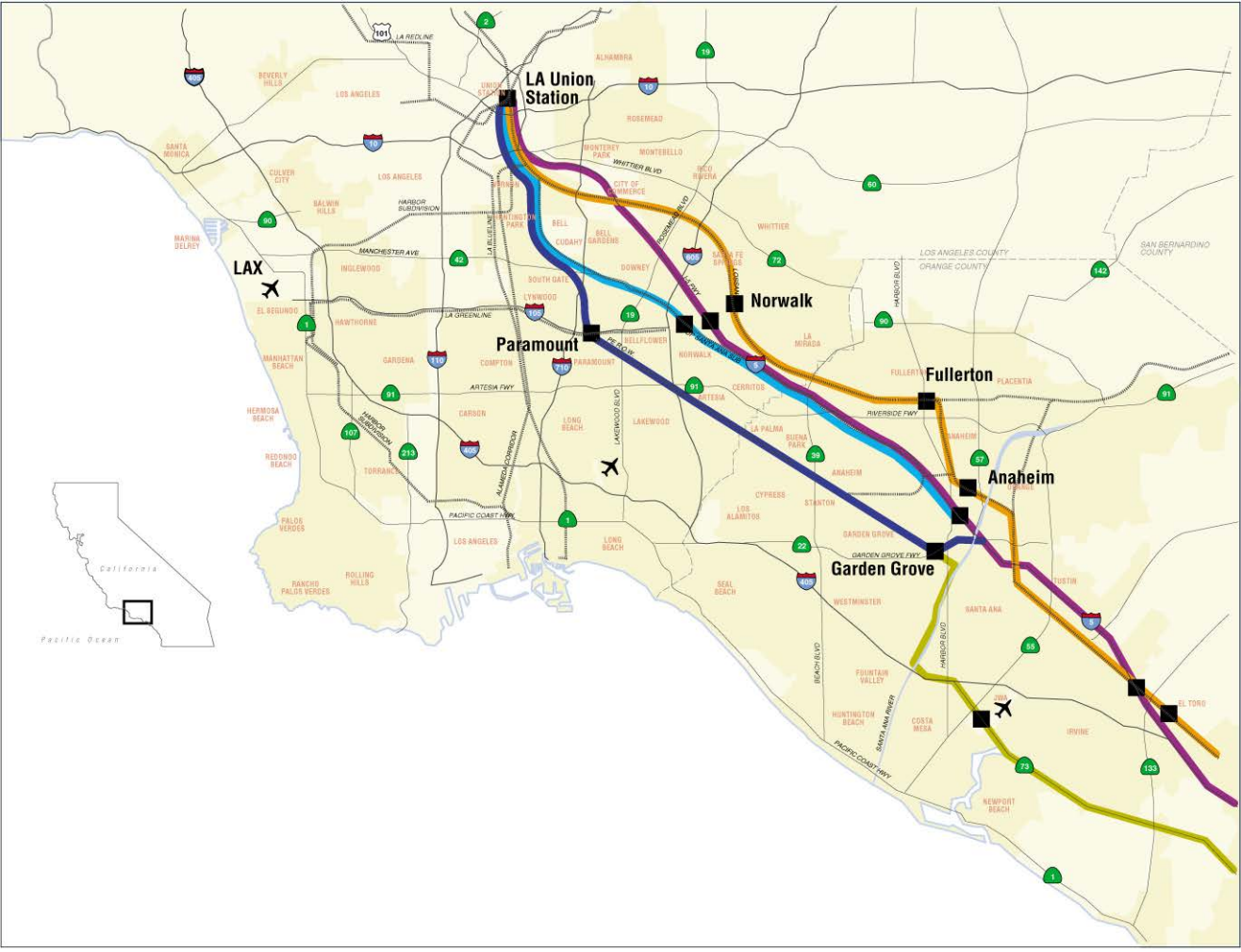
- LA Union Station run-through tracks, as described in Option B1b.
- Crossings along this corridor would be completely grade-separated. Grade-separation of crossings would generally involve lowering streets to pass beneath the tracks. Many of the new grade-separations would be south of Fullerton Junction.
- Construct a flyover for two passenger train tracks at Hobart.
- Complete fourth main track (two passenger main line tracks) from Los Angeles to Fullerton Junction.
- Provisions for electrification for two VHS tracks, including required overhead clearances.

Stations:

- *LA Union Station* (Refer to description in Option B1a)
- *Norwalk LOSSAN* (Refer to description in Option B1a)
- *Anaheim LOSSAN* (Refer to description in Option B1a)
- *Bypass tracks at Metrolink/Amtrak stations.*

No Build Conditions:

- See Option B1a notes for No Build conditions.



Source: IBI Group July 18, 2001 *California High-Speed Train Program EIR/EIS*

4 0 4 Miles

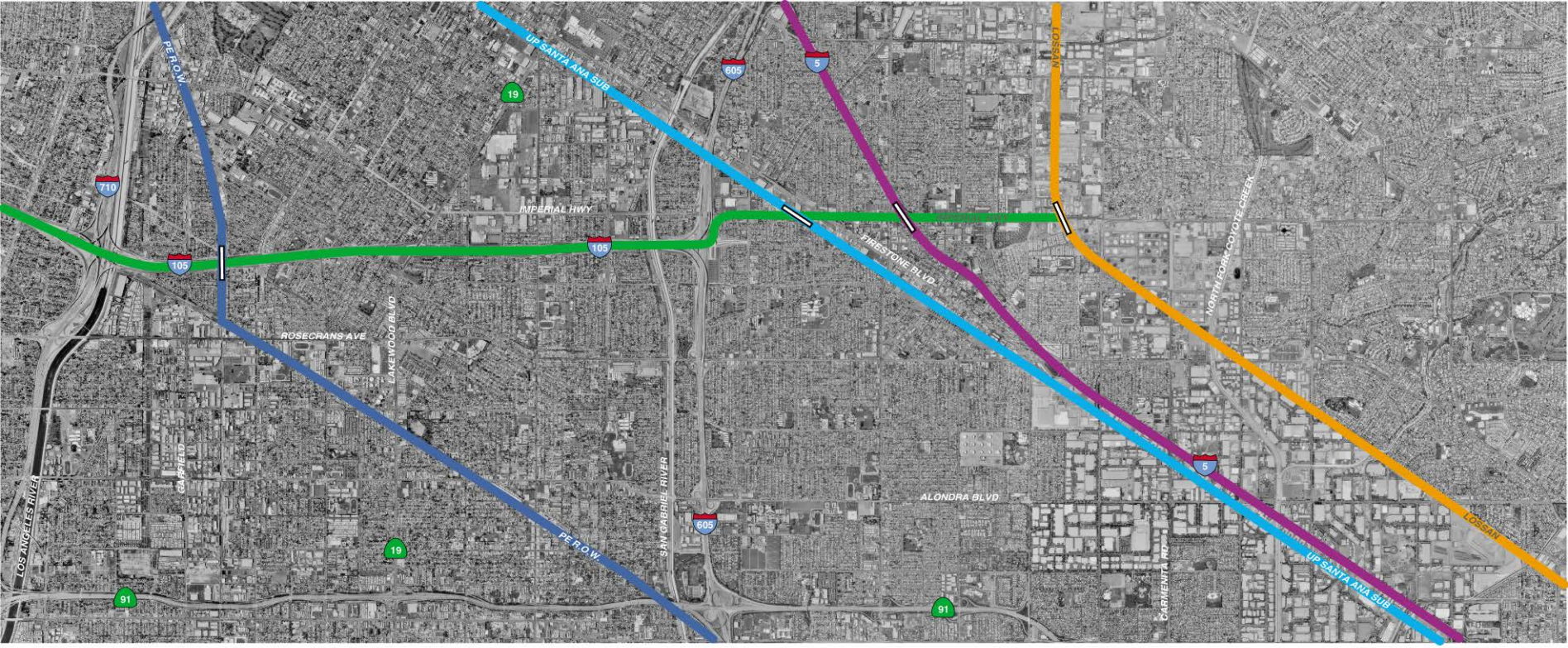
4 0 4 Kilometers

Legend

- LOSSAN (B1a/B1b)
- INTERSTATE-5 (B2)
- PACIFIC ELECTRIC ROW (B3)
- UP SANTA ANA BRANCH (B4)
- Station

Segment B - LA Union Station to Central Orange County (Anaheim)

Figure 3.4-2



Legend

- I-105/Greenline (A5)
- PE ROW (B3)
- UP Santa Ana Sub (B4)
- LOSSAN (B1/C1/D1)
- I-5 (B2/C2/D2)
- STATION

1 0 1 Mile

1 0 1 Kilometer

June 27, 2001 *California High-Speed Train Program EIR/EIS*

Figure 3.4-3
Station Areas - South East Los Angeles

June 27, 2001 *California High-Speed Train Program EIR/EIS*

Figure 3.4-4
Station Areas - Anaheim

B2 – INTERSTATE 5 FREEWAY

Configuration:

- Dedicated VHS or maglev (compatible with proposed statewide system)

Alignment:

From LA Union Station to I-10/I-5/SR-60 (East LA) interchange, this alignment follows the (future) Metrolink corridor (see B1). From the East LA Interchange to Beach Boulevard, this alignment option would follow the median of I-5 and some adjacent right-of-way. From Beach Boulevard to Euclid Avenue this alignment follows the UP Santa Ana Branch. South of Euclid Avenue, this alignment is between I-5 and Manchester Avenue (the frontage road on the west side).

Profile:

- Grade-separated (aerial, except in the UP corridor).

Stations:

- *LA Union Station* (Refer to description in Option B1a)
- *Norwalk I-5* – This station would be located near the interchange of I-5 and Imperial Highway in Norwalk. It would provide service to the Gateway Cities of Los Angeles County (Figure 3.4-3).
- *Anaheim I-5* – This station would be located on the west side of I-5 between Katella Avenue and Gene Autry Way in Anaheim. This station site was selected due to its location between the Anaheim Stadium area to the east and the Anaheim Resort to the west. The Anaheim Resort contains the Disneyland parks, Anaheim Convention Center, and numerous hotels and attractions (Figure 3.4-4).

Notes:

- From Firestone Boulevard (in Norwalk) to Beach Boulevard (Buena Park), the UP Santa Ana Branch is roughly 300 feet (93.8 meters) south of I-5 in a parallel corridor. The UP Branch is alongside I-5 from Beach Boulevard to Euclid Avenue, and crosses I-5 at Santa Ana Street (Anaheim).

B3 - PACIFIC ELECTRIC RIGHT-OF-WAY

Configuration:

- Dedicated VHS or maglev (compatible with proposed statewide system)

Alignment:

The plans for both the Caltrans and Amtrak call for the extension of the platform tracks at LA Union Station over US-101. This would allow through service at LA Union Station. The approximate alignment was described under A1. This alignment would head east from Redondo Junction along the LOSSAN corridor then south along the San Pedro Branch through the cities of Vernon, Cudahy, and South Gate, and connect to the existing PE right-of-way in Paramount (north of Rosecrans). Option B3a follows the PE right-of-way southeast from Paramount to SR-22, then east along SR-22 to I-5, allowing continuation into Option C2. Option B3b follows the PE right-of-way from Paramount to SR-22, continuing into Option C3.

Profile:

- Grade-separated. This alignment could be in a trench along most residential areas and aerial in industrial areas with a limited at-grade segment in the LA River/I-710/Rio Hondo section of South Gate.

Stations:

- *LA Union Station* (Refer to description for Option B1a)
- *Paramount* – This station would potentially be located in the PE right-of-way at I-105, between Garfield Avenue and Paramount Boulevard in the City of Paramount (Figure 3.4-3).
- *Garden Grove* – This station would be located in the PE right-of-way near SR-22 in Garden Grove in Orange County (Figure 3.4-4).

Notes:

- Currently, the tracks extend from Paramount to Beach Boulevard in Stanton. This alignment has the potential for an aerial or trench profile. There are numerous streets crossing the alignment or backing onto it.

B4 - UNION PACIFIC SANTA ANA BRANCH LINE

Configuration:

- Dedicated VHS or maglev (compatible with proposed statewide system)

Alignment:

From Los Angeles to Cudahy, see the B3 alignment described above. The San Pedro Branch crosses the UP Santa Ana Branch just west of Atlantic Avenue at Patata. This alignment option follows the UP Santa Ana Branch from Cudahy to Santa Ana Street in Anaheim. The right-of-way is a narrow, one-track line for most of its length. The northern half of the line parallels Firestone Boulevard, while the southern half parallels I-5. South of Santa Ana Street, the alignment option continues along the south side of I-5.

Profile:

- Grade-separated (Aerial through industrial areas, trench in residential, and existing profile crossing the LA River/I-710/Rio Hondo section and along I-5 from south of Beach Boulevard to Euclid Avenue.)

Stations:

- *LA Union Station* (Refer to description for Option B1a)
- *Norwalk UP* – This station would be located near the crossing of Imperial Highway and the UP Santa Ana Branch in Norwalk. It would provide service to the Gateway Cities of Los Angeles County (Figure 3.4-3).
- *Anaheim I-5* – This station would be located on the west side of I-5 between Katella Avenue and Gene Autry Way in Anaheim. This site was chosen due to its location between the Anaheim Stadium area to the east and the Anaheim Resort to the west. The Anaheim Resort contains the Disneyland parks, Anaheim Convention Center, and numerous hotels and attractions (Figure 3.4-4).

3.4.3 Segment C – Central Orange County (Anaheim) to Oceanside

Figure 3.4-5 shows the alignment and station options for the segment to Oceanside.

C1 - EXISTING LOSSAN CORRIDOR WITH DESIGN OPTIONS

Configuration:
- Upgrade to HS (C1a)
- Upgrade to HS with path to VHS (C1b)

C1A – LOSSAN CORRIDOR WITH UPGRADES

Configuration:
- Upgrade to HS (Shared-Use)

Alignment/Profile:
LOSSAN corridor from Anaheim to Oceanside. This alignment would use the existing profile (except at Orange Junction, San Juan Capistrano, and San Clemente).

Rail Corridor Improvements:
- Track and platform improvements at the Santa Ana and Irvine stations.
- Double-tracking north of San Juan Capistrano station.
- San Juan Capistrano – Double-track and depress the alignment (tunnel) at the station area.
- The addition of a second main track from Dana Point to San Onofre.
- The grade-separation and double tracking of the alignment along the beaches south of San Clemente Metrolink station.
- San Onofre to Oceanside – Complete the second main track and construct bridges at the Santa Margarita and San Luis Rey Rivers.

Stations:
- *Anaheim LOSSAN* – (Continuation from Option B1a)
- *Santa Ana station* – (Served by Amtrak)
- *Irvine LOSSAN* – This station would be located at the Irvine Transportation Center (ITC), a multi-modal facility that provides Metrolink commuter service, Amtrak service, and Orange County Transportation Authority (OCTA) bus service. It is located on the south side of the LOSSAN corridor, to the southwest of El Toro Marine Corps Air Station (Figure 3.4-6).
- *San Juan Capistrano* – (Station served by Amtrak)
- *Oceanside LOSSAN* – This station would be located at the Oceanside Transit Center on the LOSSAN corridor south of Mission Avenue in Oceanside. Metrolink and Coaster commuter service, Amtrak, and bus service is currently provided at this station, along with park-and-ride lots (Figure 3.4-7).
- *Bypass tracks at other Metrolink stations*

Source: IBI Group July 18, 2001 *California High-Speed Train Program EIR/EIS*

4 0 4 Miles
4 0 4 Kilometers

Legend

- LOSSAN (C1a/C1b)
- INTERSTATE-5 (C2)
- SR-73/SAN JOAQUIN TOLL CORRIDOR (C3)
- SR-241/FOOTHILL TOLL CORRIDOR (C4)
- Station

Segment C - Central Orange County (Anaheim) to Oceanside

Figure 3.4-5

June 27, 2001 *California High-Speed Train Program EIR/EIS*

Legend

- LOSSAN (B1/C1/D1)
- I-5 (B2/C2/D2)
- SR-73/San Joaquin TollRoad (C3)
- Foothill Toll Road (C4)
- STATION

0 0.5 1 Mile

0 0.5 1 Kilometer

Figure 3.4-6
Station Areas - Irvine

Legend

- LOSSAN (B1/C1/D1)
- I-5 (B2/C2/D2)
- STATION
- OCEANSIDE - ESCONDIDO LRT (PROPOSED BY NCTD)

0 0.5 1 Mile

0 0.5 1 Kilometer

Figure 3.4-7
Station Areas - Oceanside

No Build Conditions:

- Double tracking in northern Santa Ana from 17th Street to La Veta Avenue, is at the Draft EIR stage, and assumed to be part of the No Build condition. (This project is sometimes referred to as the "Lincoln Avenue double-track".)
- Partial double tracking between San Onofre and Oceanside is also in design and due for construction, and is part of the No Build.

C1B – LOSSAN CORRIDOR WITH FULL GRADE-SEPARATION AND BYPASSES

Configuration:

- Upgrade to HS with path to VHS

Alignment/Profile:

This alignment would modify the existing LOSSAN corridor from Anaheim to San Juan Capistrano by constructing an I-5 bypass tunnel at San Juan Capistrano, to avoid entering the historic downtown district, linking back with the LOSSAN corridor north of Dana Point. In San Clemente, the alignment would be in tunnel under I-5 to remove the alignment from the coastline, then link back up with the LOSSAN alignment in San Onofre.

Projects:

- Straightening of the Orange Junction Curve to allow for 90 mph (144 km/h) traffic, with a short tunnel.
- Grade-separation from Orange Metrolink station to 17th Street in Santa Ana.
- The construction of additional sidings and platforms at the ITC.
- The alignment would be rerouted toward I-5 with a tunnel under the freeway to bypass the San Juan Capistrano downtown historic district.
- Realigning the curve in Dana Point to allow for faster speeds, with double tracking throughout. A short tunnel at Pacific Highway is included.
- The line heads inland at Avenida Pico and tunnels under I-5 to bypass the beach and bluff areas in San Clemente. From Christianitos Road to San Onofre, the system would be on an aerial structure.
- Same projects as C1a, from San Onofre to Oceanside.

Stations:

- *Anaheim LOSSAN* – (Refer to description for Option B1a)
- *Irvine LOSSAN* – (Refer to description for Option C1a)
- *Oceanside LOSSAN* – (Refer to description for Option C1a)
- *Bypass tracks at other Metrolink stations*

Notes:

- See C1a notes for No Build conditions.

C2 – INTERSTATE 5 FREEWAY

Configuration:

- Dedicated VHS or Maglev

Alignment:

This alignment alternative would follow I-5 corridor through southern Orange County. It continues from options B2 and B3a.

Profile:

- Grade-separated (aerial, except tunnel through San Clemente to Christianitos Road)
- In Camp Pendleton, at-grade where right-of-way permits, and aerial to clear I-5 and rivers.
- Aerial in Oceanside

Stations:

- *Irvine I-5* – This station would be located adjacent to I-5, east of Jeffrey Road in Irvine. It would provide service to both residential and employment populations in Orange County.
- *Oceanside I-5* – This station location would be along I-5 corridor at Oceanside Boulevard in Oceanside. The proposed Oceanside-Escondido LRT would follow Oceanside Boulevard and provide an opportunity for interface with the high-speed train system.

C3 - SAN JOAQUIN CORRIDOR (SR-73) WITH INTERSTATE 5

Configuration:

- Dedicated VHS or maglev (compatible with proposed statewide system)

Alignment:

This is a continuation of Option B3b (the PE alignment). It would extend along the remainder of the PE right-of-way, from SR-22, to the SARC. There it would head south along the west side of the channel, and turn east at I-405. The alignment would follow SR-73 through central and southern Orange County before linking back with I-5 corridor in San Juan Capistrano, just south of Avery Parkway. The alignment would continue along I-5 corridor to Oceanside.

Profile:

- Grade-separated (Assume a trench in the PE right-of-way and SARC, aerial along I-405, trench along SR-73 south of John Wayne Airport, tunnel through the San Joaquin Hills, and aerial south of La Paz Road on SR-73 and I-5.)
- In San Clemente, tunneled to Christianitos, aerial to San Onofre (same as Option C2), at-grade or aerial through Camp Pendleton.

Stations:

- *Newport Beach* – This station would be located in the SR-73/San Joaquin Toll Road corridor at Jamboree Road in Newport Beach. It does not provide direct access to John Wayne Airport but is the closest possible location for a high-speed train station. An intermediate mode would be required to reach the airport (Figure 3.4-6).
- *Oceanside I-5* – (Refer to description for Option C2)

C4 - INTERSTATE 5 AND FOOTHILL CORRIDOR (SR-241)

Configuration:
- Dedicated VHS or Maglev

Alignment:
This alignment would leave I-5 corridor in Irvine, follow the SR-133 north, and turn southeast along SR-241 toll road. The toll highway corridor takes it south through the hills to Oso Parkway and an extension is proposed to San Onofre, where the alignment could then link back up with I-5 corridor.

Profile:
- Grade-separated (aerial, some tunnel in the SR-241 corridor near Arroyo Trabuco
- Same as Option C2 through Camp Pendleton and Oceanside.

Stations:
- *Irvine I-5* – (Refer to description for Option C2)
- *Oceanside I-5* – (Refer to description for Option C2)

No Build Conditions:
- SR-241 does not extend south of Oso Parkway. A Draft EIS/EIR is being prepared to document various Toll Highway alignment alternatives, including I-5 and arterial improvements without extending the toll highway. There is some risk that the eastern alignment connecting to I-5 near San Onofre (the "Far East" alignment) will not be selected, although it was the preferred alignment in 1991.

3.4.4 Segment D – Oceanside to San Diego

Figure 3.4-8 shows the three alignment options from Oceanside to San Diego.

D1 – EXISTING LOSSAN CORRIDOR WITH DESIGN OPTIONS

Configuration:
- Upgrade to HS (D1a).
- Upgrade to HS with path to VHS (D1b).

D1A - LOSSAN CORRIDOR WITH TUNNEL AT UNIVERSITY CITY

Configuration:
- Upgrade to HS

Alignment/Profile:
Improvements (double-tracking) are proposed along the existing LOSSAN corridor, with a new tunnel alignment under UTC bypassing Miramar Junction. The profile would be the existing condition, except for the tunnel.

Rail Corridor Improvements:
- *Corridor* – Grade separation of major arterials in Oceanside, Carlsbad, and Encinitas.
- *Oceanside* – Leave the tracks at-grade and add a holding track at the Oceanside Transit Center.
- *Encinitas* – Add a second track at-grade.

Source: IBI Group July 18, 2001 *California High-Speed Train Program EIR/EIS*

4 0 4 Miles

4 0 4 Kilometers

Legend

LOSSAN (D1a/D1b)

INTERSTATE-5 (D2)

Station

Segment D - Oceanside to San Diego

Figure 3.4-8

Legend

- LOSSAN (B1/C1/D1)
- I-5 (B2/C2/D2)
- STATION

0 0.5 1 Mile

0 0.5 1 Kilometer

Figure 3.4-9
Station Areas - Solana Beach

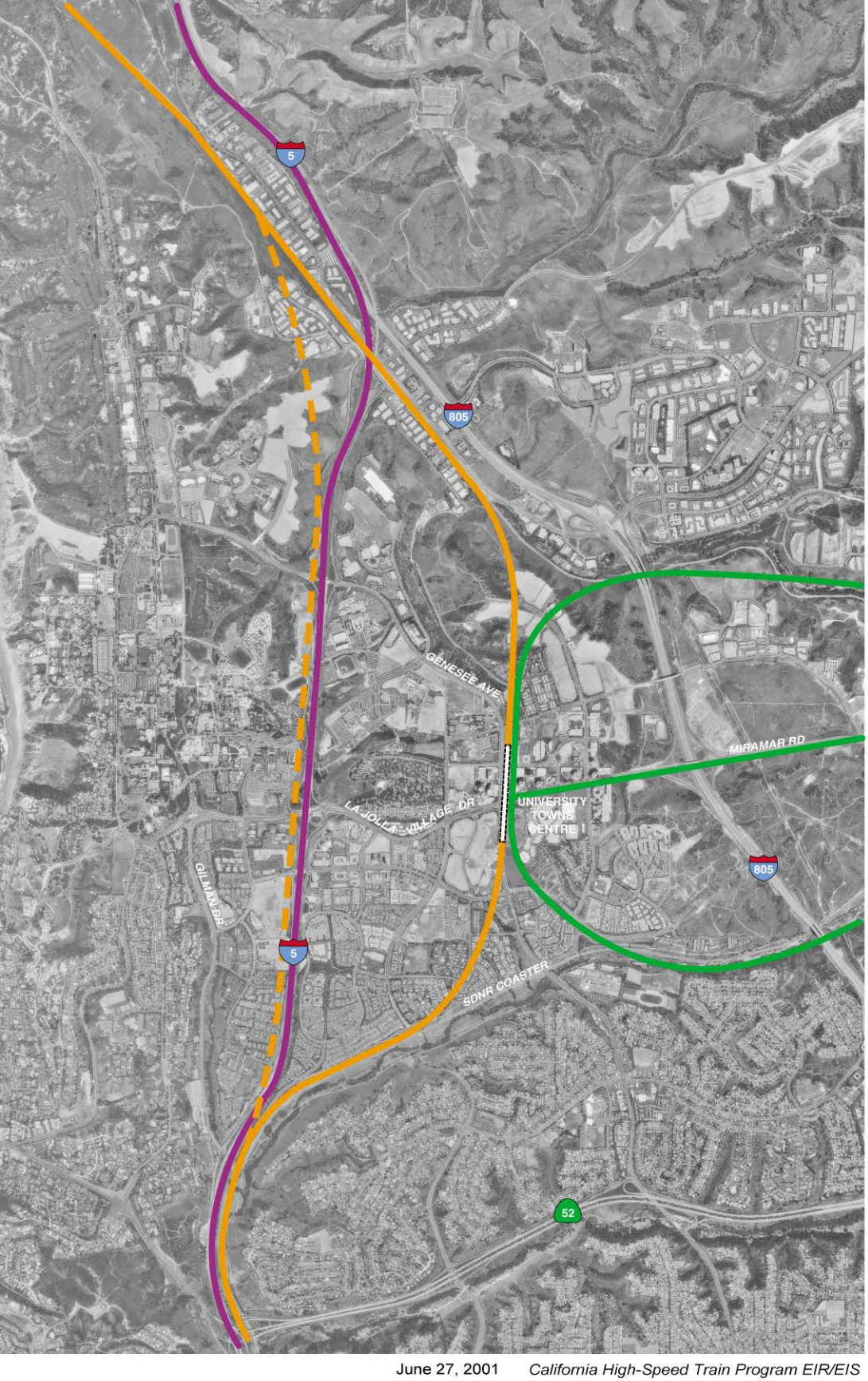


Figure 3.4-10
Station Areas - University Towne Centre

Legend

- LOSSAN (B1/C1/D1)
- I-5 (B2/C2/D2)
- STATION

0 0.5 1 Mile

0 0.5 1 Kilometer

Figure 3.4-11
Station Areas - San Diego

- *Solana Beach* – Add a second main track from Solana Beach to Del Mar and replace the bridge over the San Dieguito River.
- *Del Mar* – On the current alignment, add a second track and reinforce the bluff.
- *Miramar Hill* – A bypass tunnel under the hill would travel under UTC. The tunnel would start south of the Sorrento Valley Coaster station and rejoin the LOSSAN corridor on the western end of Rose Canyon, just south of Genesee Avenue.
- *Elvira to False Bay, Tecolote Creek to San Diego River* – Second main track.

Stations:

- *Oceanside LOSSAN* – This station was described under Option C1a, and shown on Figure 3.4-7.
- *Solana Beach LOSSAN* – This station would be located at the existing Coaster and Amtrak station in the LOSSAN corridor, to the north of the intersection of N. Coast Highway 101 and Lomas Santa Fe Drive in Solana Beach. The existing station includes two platform tracks and one bypass in a trench (Figure 3.4-9).
- *University Towne Centre* – This station would provide interface with a relocated transit center (and future LRT station) in the University City area, at La Jolla Village Drive and Genesee Avenue, midway between I-5 and I-805. It would provide a possible connection with the Los Angeles to San Diego via Inland Empire alignment for the high-speed train system (Figure 3.4-10).
- *San Diego Santa Fe Depot* – This station would be located at the historic Santa Fe Depot on the LOSSAN corridor at Broadway and Kettner Boulevard in downtown San Diego. It would provide a connection with existing Amtrak and Coaster service and the San Diego Trolley station across the street in 1 America Plaza (Figure 3.4-11).
- *Bypass tracks at other Coaster stations (Carlsbad Village, Carlsbad Poinsettia, Sorrento Valley, Old Town).*

Notes:

- *Oceanside* –The addition of a third track is already in the Amtrak 20 year plan as a priority project. The station in Oceanside will be a transportation hub for north San Diego County, with Coaster, Metrolink, Amtrak, and LRT service (Oceanside to Escondido).
- *Miramar Hill to Airport / Santa Fe Depot* – Currently the corridor is primarily grade-separated from Rose Canyon south to Old Town. South of Old Town, there are frequent grade crossings through to the Santa Fe Depot in downtown San Diego.

D1B - LOSSAN CORRIDOR WITH TUNNEL UNDER I-5

Configuration:

- Upgrade to HS with path to VHS.

Alignment/Profile:

Improvements and upgrades along the LOSSAN corridor in San Diego County, with a new alignment to bypass the Del Mar Bluffs, and a second tunnel under I-5 from Sorrento Valley to Elvira. Complete grade-separation with clearance for overhead electrification.

From Oceanside to Del Mar, grade-separate the LOSSAN corridor (e.g., trench/tunnel or aerial) with new bridges over lagoon and major river crossings.

Rail Corridor Improvements:

- *Oceanside* – Fully grade separate the corridor through Oceanside.
- *Carlsbad* – Full grade-separation of the double-tracked rail corridor.
- *Encinitas* – Full grade-separation and second track.
- *Solana Beach* – Add a second main track from Solana Beach to Del Mar and replace the bridge over the San Dieguito River.
- *Del Mar* – Shift the alignment away from the bluffs. This alternative could include a tunnel under Camino Del Mar, the main arterial through the city.
- *Miramar Hill* – Bypass tunnel under I-5. This alignment is the most direct route from Sorrento Valley to Rose Canyon.
- *Elvira to False Bay, Tecolote Creek to Old Town* – Second main track
- *Old Town to Downtown* – Trench/Tunnel for passenger rail/freight tracks.

Stations:

- *Oceanside LOSSAN* – (Refer to description for Option D1a)
- *Solana Beach LOSSAN* – (Refer to description for Option D1a)
- *San Diego Santa Fe Depot* – (Refer to description for Option D1a)
- *Bypass tracks at other Coaster stations.*

Notes:

- See Notes for D1a.

D2 – INTERSTATE 5 FREEWAY

Configuration:

- Dedicated VHS or Maglev

Alignment:
This alignment option would be fully grade-separated (assuming aerial for screening) and would follow I-5 corridor from Oceanside to Washington Street in San Diego (the proposed site of a San Diego Airport station).

Profile:

- Grade-separated (generally aerial)

Stations:

- *Oceanside Interstate 5* – This potential station location would be along I-5 corridor at Oceanside Boulevard in Oceanside. The proposed Oceanside-Escondido LRT would follow Oceanside Boulevard and provide an opportunity for interface with the high-speed train system (Figure 3.4-7).
- *Solana Beach Interstate 5* – This station would be located along I-5 corridor at the interchange with Lomas Santa Fe Drive in Solana Beach (Figure 3.4-9).
- *San Diego Airport* – This station would be located near Washington Street adjacent to the San Diego Airport (Lindbergh Field) in San Diego. It would not provide a direct connection to the existing airport passenger terminal; however, the system might provide access to a potential new intermodal center at the airport (Figure 3.4-11).

4.0 ALIGNMENT AND STATION EVALUATION

Section 4.1 describes and discusses the results of the evaluation of alignment and station options within the four segments of the Los Angeles – Orange County – San Diego corridor.

The LOSSAN corridor includes two alignment options per segment, generally falling under the HS train and VHS train configurations. Since it would be possible to incorporate improvement elements from both configurations in the LOSSAN corridor, a focused comparison is presented in section 4.2.

4.1 ALTERNATIVE ALIGNMENT AND STATION OPTION COMPARISON

The Los Angeles-Orange County-San Diego corridor has been divided into four segments:

- Segment A – LA Union Station/Southeast LA County to LAX
- Segment B – LA Union Station to Central Orange County (Anaheim)
- Segment C – Central Orange County (Anaheim) to Oceanside
- Segment D – Oceanside to San Diego

The following sections and evaluation summary tables describe the evaluation results of these four segments.

4.1.1 Segment A – LA Union Station/Southeast LA County to LAX

As noted in Section 3.4.1, this segment includes five alignment options:

- Option A1 – Interstates 405 and Interstate 10
- Option A2 – MTA Harbor Subdivision
- Option A3 – Interstates 105 and Interstate 110
- Option A4 – Upgrade MTA Green Line to Support High-Speed Train
- Option A5 – MTA Green Line Extension

Station options include:

- LAX Terminal
- LA Union Station
- Norwalk; Option 1 - *Southeast Los Angeles County*
- Paramount; Option 2 - *Southeast Los Angeles County*

The evaluation of segment A is described in the rest of Section 4.1.1. Table's 4.1-1 and 4.1-5 summarize the alignment and station option results.

A. MAXIMIZE RIDERSHIP/REVENUE POTENTIAL

Travel Time

Alignment Evaluation/Comparison:

The table below lists estimated travel times (in minutes) for each alignment. A two-minute dwell time (the time spent stopped at each station) has been assumed at each station along the alignment.

Option A1 -	*Express*
1. LA Union Station	0
2. LAX	18.2

Option A2 -	*Express*
1. LA Union Station	0
2. LAX	14.4

Option A3 -	*Express*
1. LA Union Station	0
2. LAX	17.0

Option A5 -	*Local*
1. Norwalk Metrolink	0
2. Norwalk/I-605	5.9
3. *Intermediate Stations*	
4. I-105/Hawthorne	27.9
5. LAX	35.3

The three options that contemplate a direct high-speed train connection to LAX have travel times ranging from 14 to 18 minutes, with the lower end achieved by the A2 due to the shorter, more direct path of the Harbor Subdivision.

As a point of comparison, an airport shuttle using the existing High Occupancy Vehicle (HOV) system during peak period is able to make the trip in about 55 to 60 minutes. The convenience of using an airport shuttle to make the connection between a high-speed train station and LAX is hampered by the need to transfer people and luggage between the modes at LA Union Station. However, a transfer for this trip is likely inevitable – due to the size of the required station at LAX, it is highly likely that a user would need to transfer to a bus at the LAX station in order to make their final trip to their terminal. Further, it is highly unlikely and undesirable to route all high-speed trains running through LA Union Station to LAX, necessitating a transfer at LA Union Station for many LAX-bound passengers, raising the possibility of requiring two transfers to reach the user's terminal. When a transfer is considered, the cost-effectiveness of providing a direct high-speed train connection between LAX and LA Union Station is brought into question.

Length

Alignment Evaluation/Comparison: The lengths of the five alignment options are based on preliminary alignments drawn using aerial photography in AutoCAD.

Option A1	Option A2	Option A3	Options A5
23.2 miles (37.3 km)	15.8 miles (25.4 km)	20.6 miles (33.2 km)	21.1 miles total, (33.9 km)

Options A1, A2, and A3 connect LA Union Station to LAX, of which Option A2 is the most direct alignment.

Options A4 and A5 follow the same alignment (assumed from LAX to Norwalk Metrolink) but use different technologies. The A4 and A5 alignments use 15.9 miles (25.4 km) of the existing MTA Green Line and add 5.2 miles (8.3 km) of extension. These alignments do not serve LA Union Station, instead making a connection to Southeast Los Angeles County, and therefore are longer than the other options.

Population & Employment Catchment

Station Evaluation/Comparison: The population and employment forecasts for the year 2020 that are below are based on 10-mile (16 km) radii around each proposed station.

Station	2020 Population	2020 Employment
LAX Terminal	3,299,933	1,837,949
LA Union Station	4,548,087	2,021,767

Source: Southern California Association of Governments 2020 Forecasts

B. MAXIMIZE CONNECTIVITY AND ACCESSIBILITY

Intermodal Connections

Station Evaluation/Comparison: There is only one station option at each end of the LAX to LA Union Station segment, therefore comparisons between the stations are not necessary. The arterial highway connections are based on a 1-mile (1.6 km) radius around the proposed station site.

LAX Terminal – The various public transportation links available at LAX include bus service from MTA, Culver City Bus Lines, Santa Monica Big Blue Bus, and Torrance Transit. Freeway and highway connections include:

- I-405
- I-105
- Sepulveda Boulevard
- Imperial Highway
- Lincoln Avenue

LA Union Station – Like LAX, there are numerous public transportation connections at LA Union Station. These include MTA, Los Angeles Department of Transportation (LADOT) DASH, Foothill Transit, Amtrak Thru-way Buses, and the Metro Blue and Red Lines. The existing rail connections are with Metrolink, and Amtrak (Pacific Surfliner, Coast Starlight, Sunset Limited, and Southwest Chief). The closest commercial airport is LAX, 12 miles (19.3 km) to the southwest. Freeway and major arterial connections include:

- US-101 (and El Monte Busway)
- I-110
- Cesar Chavez Avenue
- Alameda Street
- Broadway
- Main Street

C. MINIMIZE OPERATING AND CAPITAL COSTS

Length

Alignment Evaluation/Comparison: The lengths of the five alignment options in this segment are estimated to be:

Option A1	Option A2	Option A3	Options A4/A5
23.2 miles (37.3 km)	15.8 miles (25.4 km)	20.6 miles (33.2 km)	5.2 miles new, (8.4 km new)

Options A1, A2, and A3 connect LA Union Station to LAX, of which Option A2 is the shortest alignment.

Options A4 and A5 follow the same alignment (assumed to be from LAX to Norwalk Metrolink), but propose a different mix of train technologies. The alignment adds 5.2 miles (8.3 km) of extension to 15.9 miles (25.4 km) of the existing MTA Green Line and, for a total length of 21.1 miles (33.8 km). Most of the capital cost for Options A4 and A5 would be associated with the new alignment only. These options are significantly shorter than A1 through A3.

Operational Issues

Alignment Evaluation/Comparison: The prospect of competing services between LAX and LA Union Station may impair operations, ridership and revenue. As described above, it is possible that existing airport shuttle services may be a competitive way of providing this connection. Also, the *Regional Transportation Plan* (RTP)[21] includes a maglev connection between LAX and LA Union Station, and this has been assumed in the No Build alternative. Given the presence of this system, a second high-speed connection would seem to be redundant.

Option A1: This alignment option along I-405 and I-10 has the longest distance. The simulated trip times for this distance were correspondingly the longest of all the options in this segment. There are several curves in this alignment that restrict speed to 50 mph (80 km/h) and further increase the trip time.

Option A2: The MTA Harbor subdivision has the shortest distance and the shortest trip times of any alignment in this segment. There are no curves tight enough to restrict speeds to 50 mph (80 km/h), but there are some curves that would restrict speed to 75 mph (120 km/h).

[21] Southern California Association of Governments. *2001 Regional Transportation Plan Update.* April 2001

Option A3: The distance and simulated trip times along I-105/I-110/I-10 have similar characteristics to Option A1 because of the curves in the alignment.

Option A4: Current FRA regulations do not allow standard and LRT trains to operate on the same track.

Option A5: This alignment was evaluated based on extending the current MTA Green Line. The simulated LRT trip times for this option combine estimates for the west and east extensions with the current MTA schedule, which includes stops at intermediate stations along the existing line.

Construction Issues

Alignment Evaluation/Comparison:

Option A1: This option runs primarily along freeway alignments between LA Union Station and LAX. Most freeway options are subject to three general issues. The first is limited available room for support columns within the median or alongside the freeway, further limited by the presence of ramps and street crossings. The lack of room is sometimes offset by the presence of frontage roads along the freeway (although not in the case of Option A1). The second issue is that ramps, overcrossings and aerial carpool lanes force the aerial high-speed train alignment to be constructed at the third or fourth level; this is also the case when the freeway alignment is already on aerial structure, and the high-speed train option would have to straddle the freeway due to constrained right-of-way. The third general issue is the difficulty of staging of construction within the freeway alignment without interrupting traffic flow. These issues apply in general to Options A1, A3, B2, C2, C3, C4 and D2.

Specific to Option A1, third or fourth level aerial construction would be required along I-10 and I-405 Freeways, due to elevated freeway segments and existing arterial overcrossings and freeway interchanges along most of these sections. An LAX Expressway (elevated bypass) is being studied for the median of I-405, from north of Marina Freeway (SR-90) to Century Boulevard. Construction of the LAX Expressway in the median may not leave sufficient room for a high-speed train system in the I-405 corridor (or could force the high-speed train alignment onto nearby arterial streets instead). A regional maglev system is proposed by SCAG along a nearly identical alignment as Option A1 from LA Union Station to LAX. If the maglev system were constructed, there would no room (and no real need due to operational redundancy) for this high-speed train alignment option.

Option A2: Most of the option follows the alignment (but not the current at-grade profile) of the MTA Harbor Subdivision freight line. A dedicated VHS alignment may not be possible on the west side of the LA River, given existing and proposed Amtrak and Metrolink routes to LA Union Station. The system is assumed to be aerial to cross the Alameda Corridor (freight) and the MTA Blue Line east of I-105 and is aerial to clear I-405 in the western part of the alignment. Grade separation (a trench is assumed for the costs) is required between those points given the number of crossing streets in the residential, commercial, and industrial areas of South-Central Los Angeles and Inglewood. The grade separation would occur alongside parts of two arterial streets, Slauson and Florence Avenues, and would require closure of at least two existing grade crossings to make the transitions, from aerial to trench and back to aerial.

Option A3: As with Option A1, third (or fourth) level aerial construction would be required along I-10, I-110 and I-105, due to elevated freeway segments and existing arterial

overcrossings. In particular, I-105 has the MTA Green Line within the median, forcing this option to straddle or run alongside the freeway. An aerial profile along I-105 may violate the glide path for Hawthorne Airport. An aerial viaduct carrying HOV lanes on I-110 may pose problems for constructing a high-speed train system within the freeway right-of-way; for cost estimating purposes, third level aerial construction has been assumed.

Option A4: The option of upgrading the existing MTA Green Line to support a high-speed train entails several safety and construction constraints that make the possibility of such an upgrade impractical. Current FRA regulations do not allow standard and light rail transit (LRT) trains to operate on the same track. High-speed trains require different station designs than those allowed for a LRT system, because of their differences in width and length. The power sources would also be incompatible in that LRT vehicles utilize much less voltage than a high-speed train would require. These differences would require reconstruction of stations on the existing alignment, and addition of new tracks with an independent power distribution system. The lack of available right-of-way also prevents the placement of additional tracks for high-speed trains along the existing alignment. In addition, there are also structural load and overhead clearance differences that would have to be addressed along the existing alignment, which is built to LRT standards.

Option A5: An extension of the Green Line northwest to LAX is recommended by the MTA[22] for the near future, and is subject to Los Angeles World Airports' current master planning exercise for the layout of LAX. The MTA assumes that non-MTA funding would be used to construct a Green Line extension to LAX from the current line. Challenges in the area include aerial construction near LAX flight paths, and fitting the alignment and station into the Central Terminal Area (CTA), which is already occupied by terminals, parking and access roadways. For a connection from I-105/I-605 to Norwalk Metrolink (the Norwalk LOSSAN station option), an extension east from I-605 would be aerial along an existing arterial highway (Imperial Highway). Third level aerial construction would be required to pass over I-5, which is aerial through part of Norwalk. This eastern extension is not part of future MTA plans.

Overall, Options A1 and A3 appear to have the most serious construction issues due to the complex freeway alignments, while Option A2 has some serious issues due to numerous grade separations along its length. Option A4 has potential fatal flaws. Option A5 includes a challenging extension to LAX but the alignment along I-105 already exists.

Capital Cost

Alignment Evaluation/Comparison: Capital cost estimates were prepared using the unit rates defined in Task 1.5.2, with the exception of the MTA Green Line extensions for Options A4 and A5, as noted in Section 2.2.1. Due to the nature of the estimates, the results here have been converted to ratings (e.g. low, medium, high).

Option A1	Option A2	Option A3	Option A4	Option A5
Very High Cost	High Cost	Very High Cost	Not Feasible	Least Cost

Of the three options connecting LAX Terminal to LA Union Station, Option A2 was estimated to have the lowest cost. This is a combination of the shorter alignment of A2, and the expensive aerial construction required along the freeways in Options A1 and A3. In particular, Option A3 is estimated to have potentially the highest cost because of the long spans and very high structures required to straddle the existing carpool lane viaduct along I-110.

[22] Los Angeles Metropolitan Transportation Authority (MTA). *Draft 2001 Long Range Transportation Plan for Los Angeles County.* February 2001.

Options A5 was estimated to have the lowest cost of the options due to the short length of new construction. Costs for Option A5 would reflect the extension of the MTA Green Line, construction of stations, and purchase of additional light rail vehicles to provide service on the extended route. Typical costs for aerial LRT are relatively high on a per mile basis ($68-94 million per mile; $43-60 million per km) but due to the short length of the extension, the total costs would be $700 million to $1.4 billion lower than Options A1, A2 and A3.

No cost has been estimated for Option A4 because it does not appear feasible without reconstructing the existing alignment and stations, given the restrictions on operation of high-speed trains and LRT on the same tracks.

Station Evaluation/Comparison: Capital cost estimates for stations are included within the alignments. At the screening level, the unit costs for stations are conceptual. The stations at LAX and LA Union Station are all part of the overall configuration of this corridor; therefore, a comparison between the stations is academic, as they are not competing options. The stations at LA Union and LAX fall under the terminal station category; the LAX station may be more expensive (as part of Options A1 though A3) because it would be a new station, while LA Union Station would require expansion of an existing facility.

Alignment Option A5 includes aerial LRT stations at LAX and Norwalk (for the analysis) at a lower cost than high-speed rail stations. Option A5 also includes new intermediate stations on Century Boulevard and on the extension to Norwalk Metrolink station. The LRT stations are estimated to be an order of magnitude less expensive than high-speed train stations.

Right-of-Way Issues/Cost

Alignment Evaluation/Comparison:

Options A1 and A3: For these options, very limited right-of-way is available adjacent to the freeway alignments, and the medians are constrained due to narrow dimensions (in particular, on I-10 and I405) or the presence of carpool lanes (on I-110 and I-105).

Option A2: MTA owns the Harbor Subdivision and may convert it to LRT or shared-use commuter rail and freight. The current alignment is a single-track freight line, which may not be wide enough to accommodate the proposed high-speed train system without taking some additional right-of-way from adjacent roads (Slauson and Florence Avenues).

Option A4: For this option, the existing LRT system is in the median of I-105 from I-405 to I-605, and there is no room for expansion to add tracks for high-speed trains or extend the stations. Right-of-way is not as constrained for the proposed new alignment. The lack of room for high-speed train tracks on the existing alignment is a potential fatal flaw for this option.

Option A5: This alignment uses 15.9 miles of the existing MTA Green Line and adds 5.2 miles west to LAX and east to Norwalk Metrolink. Both extensions would be aerial and follow the medians of existing arterial highways.

Station Evaluation/Comparison: LA Union Station is included in Options A1 through A3 and is also part of Segment B. Right-of-way is somewhat constrained by other projects at LA Union Station, such as the Pasadena Blue Line LRT, but it is an existing train station proposed for expansion.

The station at LAX has been assumed for all five options. For Option A5, the station would be a light rail transit terminus rather than high-speed trains, and would be a much smaller station than with Options A1 through A3. The station at Norwalk Metrolink (or Paramount) is discussed in the analysis for Segment B.

D. MAXIMIZE COMPATIBILITY WITH EXISTING AND PLANNED DEVELOPMENT

Land Use Compatibility and Conflicts

Land use compatibility and conflicts include consideration of proximity impacts on adjacent land uses from issues including noise, vibration, visual, traffic, and air quality impacts at stations. For the purpose of screening all alignments and stations, land use along the proposed alignment and around stations is characterized in general terms to ensure the least impacting alignment is selected for further evaluation.

Alignment Evaluation/Comparison:

Option A1: The land use is primarily low- to medium-density residential with a mixture of commercial and industrial uses. Land use around the proposed station at LAX is heavy commercial, industrial, and transportation related uses. Several parks and schools are located within 500 feet (152.4 meters) of the alignment option. The Los Angeles County Main Jail is also located adjacent to the alignment option. Land use around LA Union Station is a mixture of commercial, industrial, office space, and transportation.

Option A2: Land uses for this alignment and station options are the same as described previously for Option A1.

Option A3: Land uses along this option are primarily low to medium-density residential and commercial. Several parks and schools and other uses including the Los Angeles Southwest College, the Los Angeles Coliseum, and the University of Southern California campus are located along the alignment. The Hawthorne Municipal Airport is also located adjacent to the alignment within this option. Land use for the proposed LAX Terminal and LA Union Station is the same as described in Option A1.

Option A4: Land uses along the proposed alignment option are the same as described for Option A3. In the City of Norwalk, land uses along the alignment are primarily low-density residential with some industrial and commercial. Land uses around the proposed Norwalk and Paramount stations are a mixture of residential, commercial, and light industrial.

Option A5: Land uses within this option are the same as described for Option A4. The Coast Plaza Doctors Hospital is located within 100 feet of the proposed alignment in the City of Norwalk. Land uses for the Norwalk and Paramount stations are the same as described in Option A4.

Station Evaluation/Comparison:

LAX Terminal: Within the station area itself, transportation and utilities are the dominant land use being comprised of the LAX Central Terminal Area (CTA) and structured parking lots. The high-speed train system would reinforce the land uses at LAX. Addition of a station would not likely change the mixture of residential, commercial, and industrial uses in the area surrounding LAX. The City of Los Angeles is currently developing a Master Plan for LAX airport to support increased passenger capacity to 89 million annual passengers (MAP).

The current layout of the seven unit terminals in the CTA does present construction challenges to locating a high-speed train station on-site. The LAX Master Plan contemplates a new West Terminal that would be built to the west of the existing CTA. An additional mode, such as an Automated People Mover, would be required to connect the high-speed train station at the CTA with the West Terminal.

LA Union Station: The LA Union Station property is zoned as a transportation hub for light rail, heavy rail, commuter rail, Amtrak, and bus service. There is a strong pedestrian environment at the station and new pedestrian linkages to Arcadia and Alameda Streets are proposed. This would provide pedestrian access to the north side of downtown to such destinations as the Los Angeles Civic Center, Little Tokyo, and Chinatown.

The dominant land uses in the LA Union Station area are transportation and utilities, and public facilities. Commercial and industrial uses are located 0.25 mile (0.4 km) to the north and south. A Master Plan, the *Alameda District Plan*[23], for LA Union Station was approved by the City of Los Angeles in 1995. The plan permits high-rise development on parcels surrounding LA Union Station, while maintaining view corridors of the station itself. A high-speed train station would need to comply with the Alameda District Plan. Catellus Development Corporation is undertaking a major redevelopment effort on 51 acres surrounding LA Union Station that will create an urban activity center with a mix of uses including: offices, shops, and restaurants.

Visual Quality Impacts

Most high-speed train projects are typically large, linear facilities that traverse the landscape; and thus, can have a substantial visual effect. The U.S. Department of Transportation (USDOT) developed guidelines for assessing visual impacts associated with transportation facilities. The methodology applied in the evaluation of proposed high-speed train corridors identifies areas where there may be the potential for visual quality impacts based on perceptions of both adjacent land users (views of the train and infrastructure) and train users (views from the train). To identify areas where the greatest potential visual impact may occur, this summary evaluation describes in general terms, existing viewsheds the proposed high-speed train alignment and station options.

Alignment Evaluation/Comparison:

Option A1: This segment is located within heavily urbanized areas of suburban and downtown Los Angeles. Views to and from the proposed alignment vary from residential, commercial, office and industrial development to linear features including freeways, power lines, rail lines and related urban infrastructure. There are few areas of open space and natural vegetation occurring along the corridors. Views associated with the proposed LAX Terminal station include urbanized areas of heavy commercial, industrial, office space, freeways, and LAX. Views associated with LA Union Station exhibit areas of heavy urbanization that includes a mixture of commercial, industrial, office space, freeways, and LA Union Station. Although the option is proposed to be aerial the majority of the alignment, visual quality impacts are considered to be minor due to the already existing transportation corridors it would follow.

Option A2: The existing viewshed for the alignment and station options are similar to Option A1, except that a large portion of the alignment would be in a trench. Other portions of the alignment option would be aerial. Since a large portion of the option would have no visual

[23] Korve Engineering. *Union Station Alameda District Plan.* Prepared for Catellus Development Corporation and Ratkovich Villanueva Partnership. 1996

impact to the surrounding communities, the visual impacts associated with this option would be considered less than significant.

Option A3: The existing viewshed for the alignment and station options are similar to Option A1. Although the option is proposed to be aerial a majority of the alignment, visual quality impacts are considered to be minor due to the already existing transportation corridor it would follow.

Option A4: The existing viewshed for the alignment and station options are the same as for Option A5, described below.

Option A5: The viewsheds associated around the proposed Norwalk and Paramount stations exhibit areas of mixed residential, commercial, and light industrial. The existing viewshed for this alignment option include areas of mixed residential, commercial, and light industrial as well as views described in Option A1. This alignment option would have limited visual impacts to the surrounding communities because the majority of the alignment option would be at-grade and would use an existing transportation corridor. The aerial portion along Imperial Highway would pass between residential areas.

Station Evaluation/Comparison:

LAX Terminal: The LAX Terminal station area is comprised of manmade development including: the LAX airport facilities, parking structures, urban infrastructure, industrial, and commercial uses. There are no open space, vegetation, or water resources within the viewshed of the high-speed train station. The existing LAX area would experience only minor visual change as a result of the station. Visual quality is low in this area. Possible visuals impacts might occur to airport signage. These could be mitigated through structural and signage design at the high-speed train station area.

LA Union Station: The LA Union Station area is located within a heavily urbanized area of downtown Los Angeles. Many man made features exist in the station area including: office development, freeways, rail lines, the station terminal, and related urban infrastructure. LA Union Station itself is considered to have a high visual quality due to its architecture and urban design elements. Views to LA Union Station must be maintained by surrounding development through the provisions of the *Alameda District Plan*[24]. The integration of the high-speed train service into LA Union Station would need to maintain this visual quality. This could be achieved through enhanced structural design elements that are compatible with the design character of the existing LA Union Station.

E. MINIMIZE IMPACTS TO NATURAL RESOURCES

Wetland Resources

Identifying wetland resources located within the proposed high-speed train alignments and station options is important to identify long term permitting requirements associated with federal and state regulations. The proposed alignments and stations should avoid or minimize impacts to wetlands, surface water resources, and natural drainages.

Alignment Evaluation/Comparison:

[24] Korve Engineering. *Union Station Alameda District Plan.* Prepared for Catellus Development Corporation and Ratkovich Villanueva Partnership. 1996

Option A1: Wetland and riparian areas known to occur within this option are associated with the Los Angeles River, Ballona Creek, and Centinela Creek.

Option A2: Wetland and riparian areas known to occur within this option are associated with the Los Angeles River.

Option A3: Wetland and riparian areas known to occur within this option are associated with the Los Angeles River and Dominguez Creek.

Option A4: Wetland and riparian areas known to occur within this option are associated with the Los Angeles River, Dominguez Creek, and Compton Creek.

Option A5: Wetland and riparian areas known to occur within this alignment are associated with the Los Angeles River, Dominguez Creek, Compton Creek, and the San Gabriel River.

Station Evaluation/Comparison: There are no wetland or riparian areas that would be impacted by LA Union Station, the Norwalk, Paramount or the LAX Terminal station.

Water Resources

Identifying water resources located within the proposed alignments and stations is important to identify long term permitting requirements associated with federal and state regulations. The proposed high-speed train corridors should avoid or minimize impacts to water resources, watersheds, and natural drainage patterns.

Alignment Evaluation/Comparison:

Option A1: There are three surface water resources crossed by this alignment option, the Los Angeles River, Ballona Creek, and Centinela Creek.

Option A2: There is one surface water resource crossed by this alignment option, the Los Angeles River.

Option A3: There are two surface water resources crossed by this alignment option, the Los Angeles River and Dominguez Creek.

Option A4: There are three surface water resources crossed by this alignment option, the Los Angeles River, Dominguez Creek, and Compton Creek.

Option A5: There are four surface water resources crossed by this alignment option, the Los Angeles River, the San Gabriel River, Compton Creek, and Dominguez Creek.

Station Evaluation/Comparison: No known water resources would be impacted by LA Union Station, the Norwalk or Paramount stations, or the LAX Terminal station.

Floodplain Impacts

Floodplain zones are defined as areas subject to flooding by a 100-year flood. It is important to identify the location of floodplain zones within the proposed high-speed train corridors to ensure structures and related infrastructure are placed within safe areas in relation to the floodplains and that any construction does not result in downstream flooding.

Alignment Evaluation/Comparison: There are no 100-year floodplain zones crossed by Options A1, A3, A4, or A5 in this segment. Option A2 crosses one 100-year floodplain zone for approximately 1,150 feet (350.6 meters) by the BNSF rail line in the vicinity of Western Avenue and Slauson Avenue in Los Angeles.

Station Evaluation/Comparison: No known 100-Year floodplains would be impacted by LA Union Station, the Norwalk or Paramount stations, or the LAX Terminal station.

Threatened & Endangered Species Impacts

The protection of California's threatened and endangered species and species of special concern is managed and regulated by the United States Fish & Wildlife Service (USFWS) and the California Department of Fish and Game (CDFG). The proposed high-speed train alignment and station options should be designed to avoid or minimize impacts to these species and their habitats. For screening purposes, threatened and endangered species and species of special concern known to occur within the proposed Los Angeles to San Diego via Orange County coastal alignment and station options are identified as follows.

Alignment Evaluation/Comparison:

Option A1: The following three threatened and endangered species and species of special concern are known to occur within this alignment option:

- Coastal Dunes Milk-Vetch (Endangered: Federal and State listing)
- Coastal California Gnatcatcher (Threatened: Federal listing)
- Santa Barbara Morning Glory (Species of Special Concern)

Option A2: The following three endangered species and species of special concern are known to occur within this alignment option:

- Coastal Dunes Milk-Vetch (Endangered: Federal and State listing)
- Coulter's Goldfield's (Species of Special Concern)
- Southern Tarplant (Species of Special Concern)

The Coast Dunes Milk-Vetch (Endangered: Federal and State listing) is the only endangered species along the alignments of Options A3, A4, and A5.

Station Evaluation/Comparison: There is little potential for impacts to any threatened or endangered species at LA Union Station or the stations in Norwalk or Paramount. One species, the Coastal Dunes Milk Vetch, may be impacted by the proposed LAX Terminal station.

F. MINIMIZE IMPACTS TO SOCIAL AND ECONOMIC RESOURCES

Environmental Justice Impacts (Demographics)

Executive Order 12898 requires that appropriate and necessary steps be taken to identify and avoid "disproportionately high and adverse" effects to projects on the health and environment of minority and low-income populations. The proposed high-speed train project would be required to comply with this order; thus, known areas where low-income and minority populations reside within proximity to the proposed corridors are identified below. Data from the 1990 U.S. Census was used for this analysis.

Locations of minority populations and low-income households were identified where the minority population or low-income households within 1990 Census Bureau block groups exceeded 50 percent of the total population or number of households within the block group.

Alignment Evaluation/Comparison:

Option A1: Minority populations that are potentially affected by this option were identified in several 1990 Census block groups in the cities of Los Angeles, Inglewood, Baldwin Hills, and an unincorporated portion of Los Angeles County. The minority population potentially affected within these block groups was estimated to be approximately 105,000 people. Low-income households were identified in several block groups in the city of Los Angeles. Within these block groups, the alignment option could potentially impact an estimated 540 low-income households.

Option A2: Minority populations that are potentially affected by this option were identified in several 1990 Census block groups in the cities of Los Angeles, Inglewood, Vernon, Huntington Park, and an unincorporated portion of Los Angeles County. The minority population potentially affected within these block groups was estimated to be approximately 43,000 people. Low-income households were identified in several block groups in the city of Los Angeles. Within these block groups, the alignment option could potentially impact an estimated 609 low-income households.

Option A3: Minority populations that are potentially affected by this option were identified in several 1990 Census block groups in the cities of Los Angeles and Inglewood. The minority population potentially affected within these block groups was estimated to be approximately 154,000 people. Low-income households were identified in several block groups in the city of Los Angeles. Within these block groups, the alignment option could potentially impact an estimated 900 low-income households. Much of this alignment already exists, reducing any impacts to minority or low-income populations.

Option A4: Known environmental justice concerns occurring along this option would be similar to Option A5, described below.

Option A5: Minority populations that are potentially affected by this option were identified in several 1990 Census block groups in the cities of Los Angeles, Inglewood, Hawthorne, Gardena, Paramount, Downey, Bellflower, and Norwalk. The minority population potentially affected within these block groups was estimated to be approximately 128,000 people. Low-income households were identified in several block groups in the city of Los Angeles. Within these block groups, the alignment option could potentially impact an estimated 986 low-income households.

Station Evaluation/Comparison: There is potential impact to a known minority population of approximately 22 people in close proximity to LA Union Station. There are no known minority populations at the proposed station at LAX. There are no census tract block groups identified as having a majority of low-income households within the immediate area of LA Union Station or the proposed LAX Terminal station.

There are potential impacts to known minority populations of approximately 3,300 people in proximity to the Norwalk station located along the LOSSAN corridor; 2,800 people in proximity to the proposed Norwalk station located along I-5; 2,800 people in proximity to the proposed Norwalk station located along the UP rail line; and approximately 3,250 people in proximity to the proposed Paramount station. There are known impacts to low-income housing of approximately five households at both the Norwalk station located along the LOSSAN corridor and the Norwalk station proposed along the Union Pacific rail line. No known low-income households are known to occur around the vicinity of the proposed Norwalk station along I-5 or the proposed Paramount station.

Community and Neighborhood Impacts

Physical barriers or divisions of established communities caused by the construction and operation of the proposed high-speed train system must be identified as part of the screening process. Using general plans for each city with the proposed alignment and station options, established neighborhoods are identified.

Alignment Evaluation/Comparison:

Option A1: Beginning near the I-405/I-105 interchange at the proposed LAX terminal station, this alignment option would parallel I-405 and I-10 through the cities of Los Angeles and Inglewood and the communities of Lennox (Los Angles County); Fox Hills (Culver City); Palms, Mar Vista, Cheviot Hills, Mid-City, and Jefferson Park (Los Angeles). The high-speed train would not cause a physical barrier to these communities and neighborhoods since the alignment would follow an already existing freeway corridor. In downtown Los Angeles, the proposed alignment would leave I-10 and follow the BNSF railroad (River Subdivision) to LA Union Station. This alignment option would not cause any physical barriers or divisions within the communities and neighborhoods listed because the alignment would follow already existing transportation corridors.

Option A2: This segment of the option would start from the proposed LAX station at I-405/I-105 interchange and parallel I-405 through the Inglewood and the community of Lennox (Los Angeles County). The alignment would connect with the BNSF railroad line that parallels Florence Avenue and Slauson Avenue through the cities of Inglewood, Los Angeles, Vernon, and Huntington Park and the community of Hyde Park (City of Los Angeles). At Santa Fe Avenue in Vernon, the proposed alignment heads north/south along the BNSF railroad to LA Union Station. This alignment option would not cause any physical barriers or divisions within the communities and neighborhoods listed because the alignment would follow already existing transportation corridors.

Option A3: From the proposed LAX Terminal station, this alignment option would parallel the MTA's Green Line along I-105 to the interchange with I-110. This portion of the alignment would pass through the cities of Hawthorne, Inglewood, Los Angeles, and through or adjacent to the communities of Lennox, Athens (Los Angles County), and unincorporated Los Angeles County. Along I-110, the alignment would parallel the freeway corridor in a north/south direction through the City of Los Angeles to downtown, connect to I-10, then follow the BNSF railroad to LA Union Station. This alignment option would cause a minor

physical barrier and division within the communities and neighborhoods listed, because it expands the existing transportation corridors.

Option A4: If construction and operation were feasible, this option would have the same alignment as Option A5, described below.

Option A5: This alignment option would start from the LAX station and follow the MTA Green Line along I-105 to the interchange with I-110. This portion would pass through the cities of Hawthorne, Inglewood, Los Angeles, and through or adjacent to the communities of Lennox, Athens (Los Angles County), and unincorporated Los Angeles County. From the interchange with I-110, this segment would continue along the MTA Metrolink Green Line/I-105 corridor through the cities of Los Angeles, Lynwood, Paramount, South Gate, and Downey and the communities of Willowbrook (Los Angeles County) and Hollydale (South Gate). An eastward extension from I-605/I-105 to the Norwalk LOSSAN station would be aerial and follow Imperial Highway through established commercial areas. This alignment option would not cause any physical barriers or divisions within the communities and neighborhoods listed because the alignment would follow already existing transportation corridors, and would be aerial along Imperial Highway.

Station Evaluation/Comparison: Communities and neighborhoods potentially impacted by the proposed LAX Terminal station would include the cities of Los Angeles, Hawthorne, and Inglewood and the communities of Lennox and Del Aire. Impacts to each city or community would depend upon proposed station site and location.

Communities and neighborhoods potentially impacted by LA Union Station would include the City of Los Angeles and the downtown district of Chinatown. Chinatown would not be divided or have any physical barriers associated with the alignment options. As LA Union Station is an operational rail station in current use, most impacts would be related to potential additional traffic accessing the station.

Farmland Impacts

The purpose of this analysis is to identify farmlands in proximity to the alternative high-speed train alignment and station options that are classified as Prime, Unique, or Farmland of Statewide Importance. Additionally, this screening report identifies farmlands that local municipalities have designated as having local importance. Digital farmland mapping was obtained from the U.S. Natural Resources Conservation Service (NRCS) and was used to identify farmland resources.

Alignment Evaluation/Comparison: There are no prime or unique farmlands or farmlands of statewide importance within the right-of-way of any proposed alignment options.

Station Evaluation/Comparison: No farmland impacts are anticipated to occur at the proposed LAX Terminal station or at LA Union Station.

G. MINIMIZE IMPACTS TO CULTURAL RESOURCES

Cultural Resources Impacts

Cultural resources include historic properties, bridges, districts, archaeological sites and sites that could be considered sacred to Native American groups. Impacts to these resources fall under several federal laws including Section 106 of the National Historic Preservation Act and Section 4(f) of the Department of Transportation Act. These regulations require consideration

of the effects to historic properties listed in or eligible for the National Register of Historic Places (National Register) and consideration of feasible and prudent avoidance alternatives under Section 4(f). To minimize impacts, known resources are identified for each alignment and station option.

Alignment Evaluation/Comparison:

Option A1: One site of cultural or historic significance occurs west of I-405 north of Florence Street. Two sites are located along I-10 adjacent to the alignment. These are identified as Los Angeles Library system branches.

Option A2: Several sites are located in proximity to the MTA Harbor Subdivision, generally west of I-110 freeway.

Option A3: Several known cultural or historic sites occur along I-110. No known sites occur along I-105 corridor or along I-10 corridor east of I-110.

Option A4: Based on data provided, there are no known sites of cultural or historic significance in proximity to the proposed alignment.

Option A5: Based on data provided, there are no known sites of cultural or historic significance in proximity to the proposed alignment option.

Station Evaluation/Comparison: LA Union Station is listed on the National Register. There are no cultural resources that occur in the immediate vicinity of the proposed Terminal station at LAX.

Parks & Recreation/Wildlife Refuge Impacts

Section 4(f) of the United States Department of Transportation Act of 1966 provides protection to certain cultural resources and parks and recreation areas. Section 4(f) resources include any publicly owned land in a public park, recreation area, or wildlife and waterfowl refuge area. To minimize impacts, known parks and recreation resources (i.e., including community parks) occurring along the proposed alignment and station options are identified.

Alignment Evaluation/Comparison:

Option A1: The following eight parks and recreation/wildlife refuge resources are known to occur within or along this alignment.

- El Pueblo De Los Angeles State Historic Park
- Toberman Playground
- 2nd Avenue Park
- Genesee Avenue Park
- Woodside Park
- Palms Park
- Culver Slauson Park
- Ashwood Park

Option A2: The following three parks and recreation/wildlife refuge resources are known to occur within or along this alignment.

- Theresa Lindsay Park
- Vincent Park
- Inglewood Park

Option A3: The following three parks and recreation/wildlife refuge resources are known to occur within or along this alignment.

- Exposition Park/Los Angeles Coliseum and Sports Arena
- Theresa Lindsay Park
- Jesse Owens County Park

Option A4: The following two parks and recreation/wildlife refuge resources are known to occur within or along this alignment.

- All American Park
- Vista Verde Park

Option A5: The following two parks and recreation/wildlife refuge resources are known to occur within or along this alignment.

- All American Park
- Vista Verde Park

Station Evaluation/Comparison: The El Pueblo De Los Angeles State Historic Park is the only park resource identified in the vicinity of LA Union Station. There are no parks and recreation/wildlife resources that occur near the proposed stations at the LAX Terminal, in Norwalk, or Paramount.

H. MAXIMIZE AVOIDANCE OF AREAS WITH GEOLOGIC AND SOILS CONSTRAINTS

Soils/Slope Constraints

Soils and slope constraints include soils with high erodibility, soils with high propensity to shrink or swell under certain moisture conditions, and steep slopes (i.e., slopes greater than nine percent). Avoidance of these areas is important because of safety, structural stability, construction difficulty and cost of mitigation. There was no specific classification of soil types other than numeric codes from the sources of data received to perform this evaluation. The different soil types are quantified by soil code in this report. Alignments and stations having soil or slope concerns are identified below.

Alignment Evaluation/Comparison:

Option A1: There are three distinct soil types within this alignment option. Areas of potential liquefaction occur along I-10 and I-405 near the intersection with I-10.

Option A2: Soil types within this option are the same as described in Option A1. Liquefaction potential occurs in an area east of I-110. Localized areas of potential earthquake induced landslides are the same as described in Option A1.

Option A3: Soil types within this alignment option are the same as described in Option A1. Liquefaction potential is indicated along I-110 south of Vernon Street to approximately Century Boulevard. There is no potential for liquefaction shown for I-105 within the study area. Some localized areas of potential earthquake induced landslides are the same as described in Option A1.

Soil types for Options A4 and A5 are the same as described in Option A1. East of I-110, the potential for liquefaction occurs along the entire corridor.

Station Evaluation/Comparison: No liquefaction potential is indicated in proximity to LAX or the proposed LAX Terminal station. Some localized areas of potential earthquake induced landslide occur in proximity to LA Union Station. The same soil type occurs at the proposed LAX Terminal station and LA Union Station within this option and at the proposed Paramount and Norwalk stations.

Seismic Constraints

Identifying areas of known active seismic areas and faults is important in developing adequate safety measures for the high-speed train system. As part of the initial screening evaluation, the distribution and nature of known active faults and potentially damaging seismogenic sources along each of the alignment options are identified.

Alignment Evaluation/Comparison: The Palos Verdes, Newport-Inglewood, and Malibu faults are active seismic areas known to occur within the general vicinity of all alignment options for this segment.

Station Evaluation/Comparison: There are potential impacts to LA Union Station and the proposed LAX Terminal station from the Palos Verdes, Newport-Inglewood, and Malibu faults.

I. MAXIMIZE AVOIDANCE OF AREAS WITH POTENTIAL HAZARDOUS MATERIALS

Hazardous Materials/Waste Constraints

When developing transportation infrastructure in California, state policy is to avoid, wherever possible, all known areas containing hazardous waste and materials. The following identifies known sites along the proposed high-speed train alignments and station options where hazardous materials or waste constraints are known to occur.

Alignment Evaluation/Comparison:

Option A1: Several known hazardous material/waste sites occur along I-405 and I-10. The greatest concentration of sites occurs in proximity to LA Union Station along the LOSSAN corridor. Most hazardous material/waste sites are likely related to railroad operation and maintenance activities.

Option A2: Numerous hazardous material/waste sites are located adjacent to the MTA Harbor Subdivision. The greatest concentration of hazardous material/waste sites are located in the vicinity of the Alameda Corridor and are most likely related to railroad operation and maintenance activities.

Option A3: Several hazardous waste sites occur along I-105 corridor. None are shown adjacent to I-110. As noted above, there are hazardous material/waste sites along I-10 corridor with the greatest concentrations occurring in proximity to LA Union Station.

Option A4/A5: Several sites are located along the extension to the MTA Green Line in proximity to Imperial Highway.

Station Evaluation/Comparison: There are no known hazardous material/waste sites in the immediate vicinity of LA Union Station or the proposed LAX Terminal station. There are two known hazardous material/waste sites in the immediate vicinity of the Norwalk Metrolink station.

4.1.2 Segment B – LA Union Station to Central Orange County (Anaheim)

As noted in Section 3.4.2, this segment includes five alignment options:

- Option B1a - LOSSAN corridor with three Main Tracks to Fullerton
- Option B1b - LOSSAN corridor with four Main Tracks to Fullerton
- Option B2 – Interstate 5 Freeway
- Option B3 – Pacific Electric Right-of-Way
- Option B4 – Union Pacific Santa Ana Branch Line

Station options include:

- Norwalk (LOSSAN) – *Serves Metrolink; Options B1a and B1b*
- Norwalk (I-5) – *Option B2*
- Norwalk (UP) – *Option B4*
- Paramount – *Option B3*
- Fullerton – *Serves Amtrak and Metrolink; Option B1a*
- Anaheim (LOSSAN) – *Serves Amtrak and Metrolink; Options B1a and B1b*
- Anaheim (I-5) – *Options B2 and B4*
- Garden Grove – *Option B3*

The evaluation of Segment B is described in the rest of Section 4.1.2. Tables 4.1-2, 4.1-6, and 4.1-7 summarize the alignment and station evaluation results.

A. MAXIMIZE RIDERSHIP/REVENUE POTENTIAL

Travel Time

Alignment Evaluation/Comparison:

The table below lists estimated travel times (in minutes) for each alignment. A two-minute dwell time has been assumed at each station along the alignment.

Option B1a –	*Local*	*Express**
1. LA Union Station	0	0
2. Norwalk	11.7	
3. Fullerton	19.4	
4. Anaheim	25.4	19.4

Option B1b –	*Local*	*Express*
1. LA Union Station	0	0
2. Norwalk	11.1	
3. Anaheim	21.7	18.3

Option B2 –	*Local*	*Express*
1. LA Union Station	0	0
2. Norwalk	11.8	
3. Anaheim	22.1	19

Option B3 –	*Local*	*Express*
1. LA Union Station	0	0
2. Paramount	9.6	
3. Garden Grove	19.2	16.4

Option B4 –	*Local*	*Express*
1. LA Union Station	0	0
2. Norwalk	11.4	
3. Anaheim	20.9	17.1

* As B1a does not include bypass tracks at stations, operational modeling is required to determine whether or not it can support express services.

Length

Alignment Evaluation/Comparison: The lengths of the five alignment options are based on preliminary alignments drawn using aerial photography in AutoCAD.

Option B1a	Option B1b	Option B2	Option B3	Option B4
30.0 miles (48.3 km)	30.0 miles (48.3 km)	28.3 miles (45.5 km)	28.7 miles (46.2 km) (LA Union Station to Garden Grove only)	28.7 miles (46.2 km)

Options B2, B3, and B4 are the shortest alignments from LA Union Station to Central Orange County. Options B1a and B1b follow the same alignment.

The length shown for Option B3 includes the 28.7-mile (46.2 km) section from LA Union Station to the station option in Garden Grove. In order to connect Option B3 to other alignment options, such as C2 (which follows I-5), and additional 3.5 mile (5.6 km) section would be required south of the station.

Population & Employment Catchment

Station Evaluation/Comparison: The population and employment forecasts for the year 2020, listed in the table below, are based on 10-mile (16 km) radii around each proposed station.

Station	2020 Population	2020 Employment
Norwalk – LOSSAN	3,085,202	1,460,673
Norwalk – I-5	3,230,260	1,468,155
Norwalk – UP	3,713,693	1,616,168
Paramount – PE	3,269,933	1,436,802
Fullerton	2,562,959	1,275,854
Anaheim – LOSSAN	2,456,616	1,455,235
Anaheim – I-5	2,588,844	1,484,922
Garden Grove – PE	2,628,764	1,546,843

Source: Southern California Association of Governments 2020 Forecast

B. MAXIMIZE CONNECTIVITY AND ACCESSIBILITY

Intermodal Connections

Station Evaluation/Comparison: Station locations being compared and evaluated in this section are those for Southeast Los Angeles and Central Orange County.

Option B1a/B1b; Norwalk: This site is located at the existing Norwalk/Santa Fe Springs Metrolink station and therefore already has public transportation and rail connections. These include connections to bus routes from MTA and Norwalk Transit. The only rail connection is provided by Metrolink. The closest airport connection is Long Beach Airport about 8 miles (12.9 km) to the south, which has limited commercial flights. The freeways and major arterials within a 1-mile (1.6 km) radius of this station include:

- I-5
- Imperial Highway
- Norwalk Boulevard
- Carmenita Road

Option B2; Norwalk: This site, located at the intersection of I-5 and Imperial Highway in Norwalk, also has MTA and Norwalk Transit Bus routes that already serve the area. However, there is no current rail line at this location, therefore there are no existing rail connections. Like the Norwalk Metrolink station, the closest airport connection is Long Beach Airport about 8 miles (12.9 km) to the south, which has limited commercial flights. The freeways and major arterials within a 1-mile (1.6 km) radius of this station include:

- I-5
- Imperial Highway
- Norwalk Boulevard
- Pioneer Boulevard
- Firestone Boulevard
- Studebaker Road

Option B3; Paramount: The proposed station in Paramount is located where the San Pedro Subdivision rail line crosses the MTA Green Line. This location provides public transit connections to MTA buses. A new station platform on the MTA Green Line would be included with the proposed high-speed train station to allow transfers. The San Pedro short line is a low use freight line that currently offers no passenger connections. Long Beach Airport is also the closest to this station alternative at a distance of 6 miles (9.7 km) to the south, making

the airport closest to this station. The freeways and major arterials within a 1-mile (1.6 km) radius of this station include:

- I-105
- I-710
- Garfield Avenue
- Paramount Boulevard
- Rosecrans Avenue

Option B4; Norwalk: Located at the intersection of the Union Pacific Santa Ana Branch and Imperial Hwy, this site currently has similar public transit connections to the LOSSAN and I-5 alternatives. A dedicated freight short line exists at this site and does not offer any existing passenger connections. Like the Norwalk LOSSAN station, the closest airport connection is the Long Beach Airport about 7 miles (11.3 km) to the south, which has limited commercial flights. The freeways and major arterials within a 1-mile (1.6 km) radius of this station include:

- I-5
- I-605
- I-105
- Imperial Highway
- Studebaker Road
- Pioneer Boulevard
- Firestone Boulevard

The station sites in Central Orange County being evaluated are:

Option B1a/b; Anaheim: The existing Anaheim station is already served by both Amtrak and Metrolink services. Public Transit options at the Anaheim station include several OCTA bus routes and other shuttles to the Anaheim resort and Disneyland areas. The closest commercial airport connection is John Wayne Airport, 9 miles (14.5 km) to the south. The freeways and major arterials within a 1-mile (1.6 km) radius of this station include:

- I-5
- SR-57
- Katella Avenue
- State College Boulevard

Option B2; Anaheim: The proposed location of this station site is between Katella Avenue and Gene Autry Way. OCTA currently has several bus routes passing near this location that could be re-routed, including the OCTA bus route along Katella Avenue, which could provide a connection to the current Anaheim Amtrak station. The closest commercial airport connection is John Wayne Airport, 8.5 miles (13.7 km) to the south. The freeways and major arterials within a 1-mile (1.6 km) radius of this station include:

- I-5
- Chapman Avenue (South)
- State College Boulevard
- Katella Avenue
- Anaheim Boulevard

Option B3; Garden Grove: This proposed station location is along the abandoned PE right-of-way at the SR-22 freeway in Garden Grove. Several OCTA bus routes serve this area, including very frequent service on Harbor Boulevard, located just east of the site. Like the Anaheim stations, the closest commercial airport connection is John Wayne Airport, 6.5 miles (10.5 km) to the southeast. The freeways and major arterials within a 1-mile (1.6 km) radius of this station include:

- SR-22
- Harbor Boulevard
- Euclid Avenue
- Westminster Avenue
- Trask Avenue

C. MINIMIZE OPERATING AND CAPITAL COSTS

Length

Alignment Evaluation/Comparison: The lengths of the five alignment options are based on preliminary alignments drawn using aerial photography in AutoCAD.

Option B1a	Option B1b	Option B2	Option B3	Option B4
30.0 miles (48.3 km)	30.0 miles (48.3 km)	28.3 miles (45.5 km)	28.7 miles (46.2 km)	28.7 miles (46.2 km)

Options B2 and B4 are the shortest alignments from LA Union Station to Central Orange County. Options B1a and B1b follow the same alignment with different amounts of track work and grade-separation.

The length shown for Option B3a is the 28.69-mile (46.18 km) section from LA Union Station to Garden Grove (where the station option is). If this option were to continue south into Option C2 (I-5), a 3.5-mile (5.6 km) section along the SR-22 to the Santa Ana River Channel (SARC) would be added.

Operational Issues

Alignment Evaluation/Comparison:

Options B1a/b: These are the longest distances in this segment. The curves are moderate and the simulated trip times fall in the mid-range of the alternatives for this segment. There were no significant differences in trip time estimates between the three-track (B1a) and fourth-track (B1b) options along this alignment. These are shared-use options and would experience some delay due to freight and other passenger rail traffic. Option B1b includes complete fourth main track from LA Union Station to Fullerton Junction, which would reduce the delays relative to Option B1a.

Option B2: The distance is in the middle range for this segment. However, this alignment follows a freeway and therefore has the most restrictive speed constraints resulting in the longest simulated trip times for the options in this segment. There are three curves limiting speed to 50 mph (80 km/h), and many other curves limiting speed to 75 mph (120 km/h).

Option B3: This distance is also in the middle range for this segment. Much of the alignment from Paramount to Garden Grove is two long tangent sections, and overall, the option has one speed-limiting curve (50 mph; 80 km/h), and the simulated trip times are the shortest of all alignments in this segment.

Option B4: The distance for this option is also in the middle range. The alignment has several curves limiting the speed to 75 mph (120 km/h), but the segments from South Gate to La Mirada and Buena Park to Anaheim are tangent, therefore the corresponding simulated trip time is relatively short.

Construction Issues

Alignment Evaluation/Comparison:

Option B1a: This option has no apparent major issues, as the No Build condition includes most of the third main track between Los Angeles and Fullerton. Completion of some parts of a fourth track would require some right-of-way widening and reconstruction of crossings.

Option B1b: This option includes the addition of a fourth main track from Los Angeles to Fullerton Junction that would require widening of right-of-way in some areas and reconstruction of numerous existing grade crossings. From Fullerton to the Anaheim station (at Edison Field), grade crossings would have to be converted to undercrossings, as no street closures were assumed.

Option B2: This option follows a freeway alignment, therefore, the general issues described for Option A1 would apply. Third level aerial construction is assumed along a significant potion of I-5 due to existing arterial and railway overcrossings, and multi-level freeway interchanges at SR-60/I-10, I-710, and I-605. This option takes advantage of the adjacent right-of-way of the UP Santa Ana Branch south of Beach Boulevard to Euclid, because recent construction has included grade-separation of arterial roads (and associated ramps) over this alignment. Thereafter, the system follows a frontage road to Anaheim, to avoid HOV structures occupying much of the freeway median.

Option B3: This option involves construction of two new grade-separated tracks within existing rail corridors. This system would be aerial (industrial areas) or in a covered trench (residential areas) due to numerous existing grade crossings in the both LA and Orange County. It is possible to cross the LA River (South Gate) and Rio Hondo at the existing profile (one road closure is needed) as these crossings are in proximity to industrial areas and I-710. This is also possible at Coyote Creek. A tunnel is required under the San Gabriel River to retain the trench profile in nearby residential areas. (It does not appear to be possible to return to grade or aerial without closing arterial roads at this location.) Two secondary tunnel crossings (Moody Creek, Anaheim/Barber Channel) would require reconstruction due to the covered trench configuration through the area.

Option B4: Similar to Option B3, this involves construction of two new grade-separated tracks in existing rail corridors. This would be a grade-separated system, either aerial (industrial areas) or trench (residential areas), due to numerous existing grade crossings in LA County and northwest Orange County. This system can follow the existing rail line's profile south of Beach Boulevard to Euclid Street, because it was grade-separated (below arterial roads) during recent construction along I-5. It is possible to cross the LA River (South Gate) and Rio Hondo at the rail line's existing profile, with transitions to and from trench on the approaches. The San Gabriel River can also be crossed at grade, with one street closure and reconstruction of two crossing streets. The Coyote Creek crossing would be aerial.

Station Evaluation/Comparison: The Norwalk-LOSSAN station is an existing site that would undergo expansion, and would likely have the fewest construction issues. The other sites are all new. The Norwalk I-5 station would have tracks in

a trench, and the Paramount station would be aerial, with vertical connections down to a new light rail platform on the MTA Green Line, in the median of I-105. Of these, the Paramount station is most complex as it would involve construction of a new Green Line station in addition to the VHS train station.

Capital Cost

Alignment Evaluation/Comparison: Capital cost estimates have been prepared using the unit rates defined in Task 1.5.2, with the exception of the adapted unit rates needed for LOSSAN Options B1a and B1b, as noted in Section 2.2.1. The preliminary capital cost estimates, were converted to the following ratings:

Option B1a	Option B1b	Option B2	Option B3	Option B4
Least Cost	Moderate	High	Highest Cost	High

Options B1a and B1b, upgrading the LOSSAN corridor, would be less expensive than the other options, with a cost difference ranging from $800 million to $1.6 billion. This is because the rail corridor already exists and can remain at grade. Much of the cost for the LOSSAN options derives from stations and grade separation of crossing streets. Option B1a has the lowest cost in Segment B, as it included less track and fewer grade separations.

Option B3 would have the highest cost, as very little of the alignment remains at grade, and a tunnel under one primary waterway was assumed in order to retain covered trench profiles through dense residential areas abutting the alignment. Option B4 has the second highest estimated cost, as the portion in LA County includes sections of trench, tunnel and aerial construction. Option B2 is third highest, as it includes some third level aerial construction at arterial and freeway overpasses, mostly in LA County.

Station Evaluation/Comparison: Capital cost estimates for stations are included within the alignments. At the screening level, the unit costs for stations are conceptual, based on the type of station being considered.

A station at the Norwalk-LOSSAN location is assumed somewhat less expensive than the Norwalk I-5, Norwalk UP and Paramount locations because an Amtrak/Metrolink station already exists at the location, offsetting some of the capital costs of a new station. Similarly, the Anaheim-LOSSAN station would be less expensive than an Anaheim I-5 or Garden Grove location.

Right-of-Way Issues/Costs

Alignment Evaluation/Comparison:

Option B1a/b: Some widening of the existing rail right-of-way would be required. Most adjacent properties are industrial, with buildings set back from the tracks. Option B1b requires more extensive widening than Option B1a due to completion of the fourth track.

Option B2: This section of I-5 was the subject of a recent Major Investment Study by the Joint Powers Authority (JPA) and Caltrans District 7. It concluded that right-of-way was a critical issue here, in that the cities along the corridor would be greatly impacted by the loss of tax revenue due to acquisition of freeway-fronting businesses. A preferred alternative consisting of widening I-5 to a 10-lane cross-section was considered the widest tolerable configuration. The lack of right-of-way requires an aerial configuration here. The aerial configuration would require less right-of-way, however, the property impacts would still be a

concern. From Beach Boulevard to Euclid Street, this option follows the UP Santa Ana Branch, a privately owned right-of-way

Option B3: The San Pedro Branch is an existing freight line, owned by BNSF. The PE right-of-way is owned by MTA and by OCTA, and is intended for some form of public transportation.

Option B4: The San Pedro Branch is an existing freight line, owned by BNSF. UP owns and operates the Santa Ana Branch. Because both of these are private rights-of-way, there would be more issues associated with this option than Options B1a/b and B3.

Station Evaluation/Comparison: Right-of-way issues are comparable at most location; however, the Norwalk–LOSSAN and Anaheim-LOSSAN stations may have the least issues, as they are existing sites with a fair amount, respectively, of vacant adjacent land and nearby surface parking. The Paramount site may have the most issues because it involves adding a Green Line station on the median of I-105.

D. MAXIMIZE COMPATIBILITY WITH EXISTING AND PLANNED DEVELOPMENT

Land Use Compatibility and Conflicts

Alignment Evaluation/Comparison:

Options B1a/b: Land uses along alignment are primarily transportation and railroad related uses with some industrial, commercial, low- to medium-density residential, open and office space. Some parks and schools are also located along the proposed alignment. Land uses around the Fullerton Station are a mixture of residential, commercial, light industrial, office space, and a multi-modal center. Land uses around the Anaheim station include commercial, light industrial, office space, a stadium, and some open space associated with the Santa Ana River.

Option B2: Land uses within this alignment are a mixture of urban development including residential, commercial and light industrial. The Los Angeles Community Hospital is located adjacent to the alignment. Several parks, schools, and cemeteries are also located along the alignment. Land uses around the Anaheim station are the same as described in Option B1a/b.

Option B3: Land uses along this alignment option are the same as described for Option B1a/b and B2. Land uses around the Garden Grove station include a mixture of commercial and light industrial, office space, and open space associated with the Santa Ana River.

Option B4: Land uses within this segment are generally the same as described for Option B1a/b and B2. Land uses for the stations within this option are the same as described in Options B2, and B3a/b.

Station Evaluation/Comparison:

Options B1a/b; Norwalk: A mix of land uses is found in the area surrounding the station including: industrial and commercial to the north, south and east; and low-density residential uses to the west. The introduction of a high-speed train service would generally be compatible with these land uses, except the adjacent residential area. The station development could provide some enhanced pedestrian connectivity between isolated land uses. It could also be a potential catalyst for redevelopment of older industrial uses in the areas that have declined with the loss of traditional industry in the region.

Option B2; Norwalk: The east side of I-5 near Imperial Highway is characterized by low to medium-density residential uses. The station would not be compatible in close proximity to development of this scale and nature. There are no opportunities on the east side of I-5 that would allow for station construction; therefore, large-scale property acquisition of residential properties would be required. The west side of I-5 contains more compatible land uses such as commercial and industrial. Some residential areas are also present, which could pose similar challenges for locating a station to those found on the east side of I-5.

Option B3; Paramount: Single-family residential land uses dominate in this area, along with some retail strip development. Paramount Park, a large recreational park is also located in this area. Placement of a high-speed train station would not be compatible with the type of uses found in this area. In addition, no vacant property exists that might accommodate a station.

Option B4; Norwalk: Issues are similar to Norwalk I-5, neighboring land uses include medium residential and some commercial.

Option B1a/b; Anaheim: Transportation, office commercial and urban entertainment uses are found within the station area. Edison International Field is located to the south of the existing station, surrounded by large surface parking areas. The parking at the station is also utilized by the commuters who ride Metrolink and Amtrak. The Sun Theatre is located to the southwest of the existing station. The *Stadium Master Plan*[25] by the city of Anaheim contemplates additional mixed-use development as infill on the stadium area parking lots. This development would be comprised of office commercial and a hotel. In addition, a large indoor recreation park is currently being planned to occupy part of the surface parking area between the station and Edison Field. A high-speed train station would be a compatible use in this environment.

Option B2; Anaheim: Within the station area, industrial uses are present immediately adjacent to I-5 on the east and west sides. Motel, mobile home parks, and residential uses are found to the west and south. There are no vacant sites to accommodate a high-speed station in this area; therefore, large-scale property acquisition would be necessary.

Option B3; Garden Grove: The area to the north of SR-22 is predominantly single-family residential with some retail commercial uses along Trask Avenue. The residential uses are considered a sensitive land use in terms of compatibility with high-speed trains. The area to the south of SR-22 is largely low intensity industrial. An electrical transformer substation is also located in this area. Single-family residential uses are in the southwest quadrant of SR-22 and Haster Street. Two mobile home parks are also in the area of the station. No vacant sites exist that would accommodate a high-speed train station; therefore, large-scale property acquisition would be necessary.

[25] SWA Group. *Anaheim Stadium Area Master Land Use Plan.* Prepared for the City of Anaheim. February 1999.

Visual Quality Impacts

Alignment Evaluation/Comparison:

Options B1a/b: Much of this option is similar to that described for option A. There is typically less heavy industry as the corridor transitions into Orange County. However, the viewshed along the alignment option remains dominated by residential, commercial and transportation/utility corridor development. Views associated with the Fullerton station include mixed residential, commercial, light industrial, office space, and the Fullerton Transportation Center located next to downtown Fullerton. Views associated with the Anaheim station include areas of office space, commercial, light industrial, Edison International Field of Anaheim (stadium), the Sun Theatre, SR-57 freeway, and the Santa Ana River. This alignment option would have insignificant visual impacts to the surrounding communities because the majority of the alignment option would be at-grade in an existing railroad corridor.

Option B2: The existing viewshed for the alignment option is the same as described for option B1. The views associated with the proposed Anaheim station include areas of office space, commercial, light industrial, Edison International Field of Anaheim (stadium), the Block of Orange (shopping mall), SR-57, SR-22, and I-5 freeways, and the Santa Ana River. This alignment option would have moderate visual impacts to the surrounding communities because the majority of the alignment option would be aerial. Once in Orange County, the alignment option would then be at-grade. The entire alignment option would transverse an existing freeway corridor.

Option B3: The existing viewshed for this alignment station options are similar as described for options B1 and B2. The alignment would have little or no visual impacts to the surrounding communities because the majority of the alignment option would be trenched along an existing railroad corridor.

Option B4: The existing viewshed for this alignment station options are similar as described for options B1 and B2. The alignment option would have minor visual impacts to the surrounding communities, because of trench construction in LA County residential areas, and at-grade through most of Orange County. The alignment would be aerial in part of Buena Park. The alignment option would be elevated near Union Station, be trenched until reaching the border of Los Angeles and Orange Counties, and would be at-grade the remaining way until reaching central Orange County. The alignment option would transverse an existing railroad corridor and freeway.

Station Evaluation/Comparison:

Options B1a/b; Norwalk: Views to and from the station include: industrial, commercial, and residential development; rail lines and urban infrastructure. The landform is level and there are no natural water resources in the area. Street trees are present. The residential areas would provide some visual sensitivity, as the station would be within site of residents. The high-speed train station would represent a visual change for these residents; however, this would be a relatively low adverse impact as the station might impede views of unattractive industrial uses beyond.

Option B2; Norwalk: Views to and from the station area include: residential development and freeway structures. As existing development would likely need to be cleared in order to make room for a high-speed train station in this area, the station would be located in close proximity to residential uses. This would represent a significant visual change in the area.

Option B3; Paramount: The station area would be viewed from residential development, retail commercial, I-105 freeway, and Paramount Park. The existing visual quality of these neighborhoods is high. The station would probably have some impact on views of Paramount Park, an important recreational resource in the community. Some vegetation of the park may possibly be lost depending upon the location of the station. The station would represent a significant change in visual character in the neighborhood.

Option B1a/b; Anaheim: The station area viewshed includes: SR-57, office commercial, Edison International Field, rail lines, large surface parking areas, and urban infrastructure. The landform is level in the station area and street trees are present. The Santa Ana River channel runs alongside SR-57 to the east. Some rolling hills are located in the distance to the north. Expansion of the existing station might have some impact on views to Edison Field from the commercial development on the north; however, this would be a low adverse effect upon visual quality in the area.

Option B2; Anaheim: The viewshed of the station area is dominated by I-5 freeway, industrial uses, and residential uses. The visual quality in the area is generally low due to the presence of the freeway. This has been mitigated to some extent by attractive retaining walls/noise barriers. The high-speed train station could further mitigate the view of the freeway. It would still represent a significant visual change for nearby residents in low-density housing. The landform is level in this area with no open space or natural vegetation.

Option B3; Garden Grove: The viewshed is dominated by SR-22, residential development, industrial development, and urban infrastructure. The visual quality is low in this area due to the presence of the freeway. The proposed station would be partially below grade, limiting visual impacts.

E. MINIMIZE IMPACTS TO NATURAL RESOURCES

Wetland Resources

Alignment Evaluation/Comparison:

Options B1a/b: Wetland and riparian areas known to occur within or adjacent to this alignment include: the LA River, Rio Hondo River, San Gabriel River, North Fork Coyote Creek, Coyote Creek, Fullerton Creek, Carbon Creek, Crescent Basin, and the Santa Ana River.

Option B2: Surface water resources known to occur within or adjacent to this alignment are the same as described for Options B1a/b.

Option B3: Wetland and riparian areas known to occur within or adjacent to this alignment include: the Los Angeles River, Rio Hondo River, San Gabriel River, Coyote Creek, and Moody Creek.

Option B4: Wetland and riparian areas known to occur within or adjacent to this alignment include: the Los Angeles River, Rio Hondo River, San Gabriel River, North Fork Coyote Creek, Coyote Creek, Fullerton Creek, Carbon Creek, and Crescent Basin.

Station Evaluation/Comparison: No impacts to wetlands are associated with LA Union Station or the proposed station sites in Southeast LA County or Central Orange County.

Water Resources

Alignment Evaluation/Comparison:

Options B1a/b: Surface water resources crossed by this alignment option include the Los Angeles River, the Rio Hondo River, the San Gabriel River, North Fork Coyote Creek, Coyote Creek, Fullerton Creek, Carbon Creek, Crescent Basin, and the Santa Ana River.

Option B2: Known impacts to surface water resources within or adjacent to this alignment would be similar to those described previously for Options B1a/b, because the same water resources are crossed at similar locations.

Option B3: Surface water resources crossed by this alignment option include the Los Angeles River, the Rio Hondo River, the San Gabriel River, Coyote Creek, Moody Creek, Stanton Storm Channel, Anaheim Barber Channel, and an unnamed channel.

Option B4: Surface water resources crossed by this alignment option include the Los Angeles River, the Rio Hondo, the San Gabriel River, North Fork Coyote Creek, Coyote Creek, Fullerton Creek, Carbon Creek, Crescent Basin.

Station Evaluation/Comparison: There are no impacts to water resources identified at the proposed station sites in southeast LA County. The proposed stations in Anaheim and Garden Grove are in proximity to Santa Ana River. The potential for impacts at these locations would be minimal.

Floodplain Impacts

Alignment Evaluation/Comparison:

Options B1a/b: The LOSSAN corridor crosses a 100-year floodplain zone for approximately 320 feet (97.6 meters) in Santa Fe Springs between Florence Avenue and Lakeland Road. The alignment also crosses a 100-year floodplain zone for approximately 100 feet (30.5 meters) in Buena Park near the intersection of Beach Boulevard and Emery Street. Another 100-year floodplain zone is crossed for approximately 210 feet (64.0 meters) near the intersection of East Street and La Palma Avenue in Anaheim. At the southern terminus of this option, a 100-year floodplain zone is crossed for approximately 425 feet (129.6 meters) near the intersection of State College Boulevard and Katella Avenue near the Anaheim train station. The total length of floodplains crossed by this option would be 1,055 feet (321.6 meters).

Option B2: At the southern terminus of this option, a 100-year floodplain zone is crossed for approximately 580 feet (176.8 meters) near the intersection of State College Boulevard and Katella Avenue near the Anaheim train station. This is the only floodplain crossed along this alignment.

Option B3: Along this alignment, a 100-year floodplain is crossed for approximately 100 feet (30.5 meters) west of I-710, north of the PE right-of-way and Fernwood Avenue within South Gate. This is the only floodplain crossed along this alignment.

Option B4: The floodplain that would be crossed along this alignment is the same as stated previously for Option B2.

Station Evaluation/Comparison: There would be no 100-year floodplain zone impacts associated with LA Union Station or the proposed station sites in Norwalk or Paramount. There are potential 100-year floodplain zone impacts with the proposed station sites in Anaheim and Garden Grove.

Threatened & Endangered Species Impacts

Alignment Evaluation/Comparison:

Options B1a/b: The San Fernando Valley Spineflower (Species of Special Concern) is known to occur within this alignment option.

Option B2: The following two species of special concern are known to occur within this alignment:

- San Fernando Valley Spineflower (Species of Special Concern)
- Southern Tarplant (Species of Special Concern)

Option B3: The following eight endangered species and species of special concern are known to occur within this alignment:

- Western Yellow-Billed Cuckoo (Endangered: State listing)
- Salt Marsh Bird's-Beak (Endangered: Federal and State listing)
- Coulter's Goldfield's (Species of Special Concern)
- San Fernando Valley Spineflower (Species of Special Concern)
- Southern Tarplant (Species of Special Concern)
- Coast Woolly-Heads (Species of Special Concern)
- Coastal California Gnatcatcher (Endangered: Federal listing)
- Light-Footed Clapper Rail (Endangered: Federal and State listing)

Option B4: The following two species of special concern are known to occur along this alignment:

- Brand's Phacelia (Species of Special Concern)
- San Fernando Valley Spineflower (Species of Special Concern)

Station Evaluation/Comparison: No impacts are anticipated to any threatened or endangered species or species of special concern from LA Union Station, or the proposed stations in Norwalk or Paramount. The San Fernando Valley Spineflower occurs in the vicinity of the proposed stations in Anaheim and Garden Grove.

F. MINIMIZE IMPACTS TO SOCIAL AND ECONOMIC RESOURCES

Environmental Justice Impacts (Demographics)

Alignment Evaluation/Comparison:

Options B1a/b: Minority populations that are potentially affected by this option were identified in several 1990 Census block groups in the cities of Los Angeles, Vernon, Bell, Commerce, Pico Rivera, Santa Fe Springs, Norwalk, Cerritos, La Mirada, Buena Park, Fullerton, and Anaheim. The minority population potentially affected within these block groups was estimated to be approximately 40,000 people. Low-income households were identified in several block groups in the cities of Los Angeles, Bell, Santa Fe Springs, and

Fullerton. Within these block groups, the alignment option could potentially impact an estimated 395 low-income households.

Option B2: Minority populations that are potentially affected by this option were identified in several 1990 Census block groups in the cities of Los Angeles, Vernon, Bell, Commerce, Downey, Santa Fe Springs, Norwalk, Cerritos, La Mirada, Buena Park, Fullerton, and Anaheim. The minority population potentially affected within these block groups was estimated to be approximately 78,000 people. Low-income households were identified in several block groups in the cities of Los Angeles and Santa Fe Springs. Within these block groups, the alignment option could potentially impact an estimated 709 low-income households.

Option B3: Minority populations that are potentially affected by this option were identified in several 1990 Census block groups in the cities of Los Angeles, Vernon, Bell, Huntington Park, Downey, Cudahy, South Gate, Lynwood, Paramount, Bellflower, Artesia, La Palma, Cypress, Stanton, Garden Grove, Cerritos, Buena Park, and Anaheim. The minority population potentially affected within these block groups was estimated to be approximately 89,000 people. Low-income households were identified in several block groups in the city of Los Angeles. Within these block groups, the alignment option could potentially impact an estimated 415 low-income households.

Option B4: Minority populations that are potentially affected by this option were identified in several 1990 Census block groups in the cities of Los Angeles, Vernon, Bell, Huntington Park, Downey, Cudahy, South Gate, Bellflower, Norwalk, Cerritos, Buena Park, Fullerton, and Anaheim. The minority population potentially affected within these block groups was estimated to be approximately 62,000 people. Low-income households were identified in several block groups in the cities of Los Angeles and Santa Fe Springs. Within these block groups, the alignment option could potentially impact an estimated 415 low-income households.

Station Evaluation/Comparison:

Options B1a/b; Norwalk: There are potential impacts to minority populations of approximately 3,300 people that are in proximity to the Norwalk station. There are also known impacts to 5 low-income households in proximity to the station.

Option B2; Norwalk: There are potential impacts to minority populations of approximately 2,800 people in proximity to the Norwalk station within this option. However, there are no known impacts are known to any low-income households in proximity to this station option.

Option B3; Paramount: Potential impacts to minority population of approximately 3,250 people are known to occur in proximity to the proposed Paramount station within this option. No known impacts, however, are known to occur to any low-income households in proximity to the proposed station.

Option B4; Norwalk: Potential impacts to minority population of approximately 2,800 people are known to occur in proximity to the Norwalk station within this option. Also, there are known impacts to 5 low-income households in proximity to the proposed station.

Options B1a/b; Anaheim: There are no impacts to any known minority population or low-income households in proximity to the Anaheim station in the LOSSAN Corridor.

Option B2; Anaheim: A potential impact to a minority population of approximately 3,200 people in proximity to the proposed Anaheim station are known to occur within this option. However, no impacts would occur to any known low-income households in proximity to the proposed station.

Option B3; Garden Grove: Potential impacts to minority populations of approximately 8,000 people are known to occur in proximity to the proposed Garden Grove station. However, no known impacts are known to occur to any low-income households in proximity to the proposed station.

Community and Neighborhood Impacts

Alignment Evaluation/Comparison:

Options B1a/b: The LOSSAN corridor runs along the existing BNSF/Metrolink corridor from LA Union Station to the Santa Fe Depot in San Diego. From LA Union Station, the alignment passes through the cities of Los Angeles, Vernon, Bell, Commerce, Montebello, Pico Rivera, Santa Fe Springs, and La Mirada; and community of Los Nietos (Santa Fe Springs). The alignment enters Orange County near Beach Boulevard in Buena Park. The alignment then continues through the cities of Buena Park and Fullerton, and turns southward along the OCTA Metrolink corridor through Anaheim. This alignment already exists, therefore the impacts would be related to widening the right-of-way and grade separation of crossings. This option would not cause any physical barriers or divisions within the communities and neighborhoods listed because the alignment would follow an existing railroad corridor.

Option B2: From LA Union Station in downtown Los Angeles, this alignment crosses city blocks to reach the interchange of US-101/I-5/I-10/SR-60 (East LA interchange) in the Boyle Heights district (City of Los Angeles). The alignment continues through East Los Angeles (Los Angeles County), the cities of Commerce, Montebello, Downey, Santa Fe Springs, Norwalk, and unincorporated areas of Los Angeles County between the cities of Cerritos and La Mirada. The alignment enters Orange County and continues through Buena Park and Anaheim. This option would not cause any physical barriers or divisions within the communities and neighborhoods listed because the alignment would follow an existing railroad corridor.

Option B3: This proposed alignment follows the existing LOSSAN corridor from LA Union Station through the cities of Los Angeles and Vernon. As the proposed alignment enters Vernon, it turns south along the San Pedro Subdivision and passes through the cities of Vernon, Maywood, Huntington Park, Bell, Cudahy, South Gate, and the southeast corner of Downey. The alignment crosses I-105 into Paramount and joins the former PE right-of-way, and continues through the cities of Bellflower, Cerritos, Artesia, La Palma, Cypress, Buena Park, Anaheim, Stanton and Garden Grove. The adjacent area along the right-of-way is an established neighborhood area with mixed uses including, residential, commercial, industrial, public uses, and open space. This option would cause a minor physical barrier within the cities of Stanton and Garden Grove because the alignment would follow an existing, but abandoned PE right-of-way. There would be no other physical barriers or divisions within the other communities and neighborhoods listed because the alignment option would follow already existing railroad corridors.

Option B4: Initially, this alignment follows the same alignment as described previously for Option B3. The proposed alignment follows the LOSSAN corridor and San Pedro Subdivision from LA Union Station to Atlantic Avenue at the border of South Gate and Cudahy. The alignment then continues east/southeast along the UP Santa Ana Branch line across the Los

Angeles River and I-710 and crosses through the cities of Bell Gardens, Downey, Norwalk, Santa Fe Springs, and adjacent parts of the County of Los Angeles. The alignment is parallel to I-5 in Orange County, passing through Buena Park and Anaheim. The alignment follows I-5 from Santa Ana Street south to the proposed station. This option would not cause any physical barriers or divisions within the communities and neighborhoods listed because the alignment would follow an existing railroad corridor.

Station Evaluation/Comparison:

Options B1a/b; Norwalk: The proposed station would be an expansion of the existing Norwalk/Santa Fe Springs Metrolink station. Impacts would be related to the expansion of the station footprint and the potential for additional traffic on Imperial Highway.

Option B2; Norwalk: The City of Norwalk would be potentially impacted by this proposed station. The station would be located along I-5 between two existing interchanges, potentially drawing station traffic into the area.

Option B4; Norwalk: The City of Norwalk would potentially be impacted by this proposed station. The proposed location along the UP corridor would require closing one local road leading into the neighborhood south of the station. There would be additional traffic on Imperial Highway and Firestone Boulevard due to station access.

Options B3; Paramount: The communities and neighborhoods potentially impacted by this proposed station would include the cities of Paramount and South Gate and the community of Hollydale. The site is midway between two freeway interchanges and access is currently by a secondary arterial, Century Boulevard. Traffic impacts would be expected in the adjacent neighborhoods.

Options B1a/b; Anaheim: Anaheim would be the only city or community to be impacted by the proposed station. The station would be at the site of the existing Amtrak/Metrolink station, with the potential impact of additional traffic accessing the station.

Option B2; Anaheim: Anaheim would be the only city or community to be impacted by the proposed station. The proposed site is on a one-way frontage road to I-5, and would draw additional traffic at the Katella Avenue and Gene Autry Way interchanges.

Option B3; Garden Grove: Garden Grove would be the only city or community to be impacted by the proposed station. Traffic would access the station via Trask Avenue, using either the Harbor Boulevard or Euclid Avenue exits off of SR-22.

Farmland Impacts

Alignment Evaluation/Comparison: There are no farmland impacts that are anticipated with alignment Options B1a, B1b, or B3 in either Los Angeles or Orange County. Along Options B2 and B4, a parcel of prime farmland is located south of I-5, west of Euclid Street in Anaheim.

Station Evaluation/Comparison: There are no impacts farmland associated with any of the proposed station sites in Norwalk, Paramount, Fullerton, Anaheim, or Garden Grove.

G. MINIMIZE IMPACTS TO CULTURAL RESOURCES

Cultural Resources Impacts

Alignment Evaluation/Comparison:

Options B1a/b: Several cultural or historic sites are located along the LOSSAN corridor in the Fullerton and Anaheim areas. The Fullerton Passenger and Freight Depot and the Kroger-Melrose District in Anaheim are National Register listed.

Option B2: A registered historic site is located east of I-5 and south of Imperial Highway in Norwalk. A historic property is located south of I-5 along Brookhurst Street in Anaheim.

Option B3/B4: No known cultural or historic sites occur along these alignment options or within this portion of the study area.

Station Evaluation/Comparison: There are no cultural resources that occur in the immediate vicinity of any of the proposed station sites in Norwalk, Anaheim, or Garden Grove. LA Union Station is a National Register listed historic landmark.

Parks & Recreation/Wildlife Refuge Impacts

Alignment Evaluation/Comparison:

Options B1a/b: The following four parks and recreation resources occur along this alignment option.

- Zimmerman Park
- Independence Park of Fullerton
- Amerige Park
- Edison International Field of Anaheim

Option B2: The following 10 parks and recreation resources occur along this alignment option.

- Pecan Playground
- Boyle Heights Sports Center Park
- Ramon Garcia Recreation Center
- Bristow Park
- Dennis the Menace Park
- Orr Park
- Norwalk Park And Sports Center
- Ramona Park
- Bellis Park
- Bacon House Park

Option B3: The following nine parks and recreation resources occur along this alignment option.

- Municipal Park (Huntington Park)
- Paramount Park
- Bellflower Golf Center
- Caruthers Park
- Rosewood Park
- Artesia Park
- Cerritos Regional County Park
- Beat Park
- Hansen Park

Option B4: The following six parks and recreation resources occur along this alignment option.

- Municipal Park (Huntington Park)
- Crawford Park
- Robert E White Park
- Vista Verde Park
- Bellis Park
- Bacon House Park

Station Evaluation/Comparison: There are no parks or recreation/wildlife refuge resources that occur in the immediate vicinity of any of the proposed station sites or locations for Norwalk, Paramount, or Garden Grove. The proposed Anaheim station locations are in the immediate vicinity of Edison International Field. Also, the El Pueblo De Los Angeles State Historic Park has been identified to be in the vicinity of LA Union Station.

H. MAXIMIZE AVOIDANCE OF AREAS WITH GEOLOGIC AND SOILS CONSTRAINTS

Soils/Slope Constraints

Alignment Evaluation/Comparison: There are two distinct soil types within all the alignment options for this segment. Some localized areas of potential earthquake induced landslides occur in proximity to LA Union Station. The potential for liquefaction occurs along every alignment option until reaching central Orange County.

Station Evaluation/Comparison: One distinct soil type occurs within the areas of all the proposed station sites. Possible impacts from liquefaction occur in the immediate vicinity surrounding the proposed sites for each of the stations. Soil types for the proposed Paramount and Norwalk stations are the same as described in Options A4 and A5.

Seismic Constraints

Alignment Evaluation/Comparison: The Newport-Inglewood and Whittier faults are active seismic areas and faults known to occur within the general vicinity of each alignment option in this option. Option B3 is the closest to the Newport-Inglewood fault. The alignment options do not cross these faults at any location.

Station Evaluation/Comparison: For each proposed station in this option, there are potential impacts from two major seismic areas and faults. The Newport-Inglewood and Whittier faults are active seismic areas known to occur within the general vicinity of the station options.

I. MAXIMIZE AVOIDANCE OF AREAS WITH POTENTIAL HAZARDOUS MATERIALS

Hazardous Materials/Waste Constraints

Alignment Evaluation/Comparison:

Options B1a/b: This option had the greatest number of hazardous material/waste sites of the Segment B alignments. Along this option, the highest concentrations are in Santa Fe Springs and Fullerton.

Option B2: Several hazardous material/waste sites occur along I-5 with the greatest concentrations occurring in the Norwalk and La Mirada areas.

Option B3: The option contains the fewest number of hazardous material/waste sites within Segment B. The greatest concentration on this alignment occurs north of I-105, along the border between South Gate and Downey.

Option B4: This option includes several sites in the industrial areas of South Gate, Cudahy, and Downey.

Station Evaluation/Comparison: There are no known hazardous material/waste sites in the vicinity of LA Union Station, the Norwalk station locations, or the proposed Paramount station. There is one known hazardous material/waste site each in the immediate vicinity of the Fullerton station and Anaheim station options. There is also one known hazardous material/waste site in the immediate vicinity of the proposed Garden Grove station.

4.1.3 Segment C – Central Orange County (Anaheim) to Oceanside

This segment includes five alignment options (described in Section 3.4.3):

- Option C1a – LOSSAN Corridor with Upgrades
- Option C1b – LOSSAN Corridor with Full Grade-Separation and Bypasses
- Option C2 – Interstate 5 Freeway
- Option C3 – San Joaquin Corridor (SR-73) with Interstate 5
- Option C4 – Interstate 5 and Foothill Corridor (SR-241)

Station options include:

- Santa Ana – *Served by Amtrak and Metrolink; Option C1a only*
- Irvine (LOSSAN) – *Served by Amtrak and Metrolink; Options C1a and C1b*
- Irvine (I-5) – *Options C2 and C4*
- Newport Beach – *Option C3 only*
- San Juan Capistrano – *Served by Amtrak and Metrolink; Option C1a only*
- Oceanside (LOSSAN) – *Served by Amtrak, Metrolink, and Coaster; Options C1a and C1b*
- Oceanside (I-5) – *Options C2, C3, and C4*

The evaluation of Segment C is described in the rest of Section 4.1.3. Tables 4.1-3, 4.1-8, and 4.1-9 summarize the alignment and station evaluation results.

A. MAXIMIZE RIDERSHIP/REVENUE POTENTIAL

Travel Time

Alignment Evaluation/Comparison:

The table below lists estimated travel times (in minutes) for each alignment. A two-minute dwell time has been assumed at each station along the alignment.

Option C1a –	*Local*	*Express*
1. Anaheim	0	0
2. Santa Ana	6.6	
3. Irvine (LOSSAN)	14.7	
4. San Juan Capistrano	23.9	
5. Oceanside (LOSSAN)	43.6	33.9

Option C1b -	*Local*	*Express*
1. Anaheim	0	0
2. Irvine (LOSSAN)	11.2	
3. Oceanside (LOSSAN)	38.5	32.1

Option C2 -	*Local*	*Express*
1. Anaheim	0	0
2. Irvine (I-5)	9.0	
3. Oceanside	35.9	33.7

Option C3 -	*Local*	*Express*
1. Garden Grove	0	0
2. Newport Beach	9.4	
3. Oceanside (I-5)	37.5	34.5

Option C4 -	*Local*	*Express*
1. Anaheim	0	0
2. Irvine (I-5)	8.9	
3. Oceanside (I-5)	39.8	36.6

Length

Alignment Evaluation/Comparison: The lengths of the five alignment options are estimated to be:

Option C1a	Option C1b	Option C2	Option C3	Option C4
55.5 miles (89.3 km)	56.1 miles (90.3 km)	55.1 miles (88.6 km)	57.6 miles (92.7 km)	60.6 miles (97.5 km)

Options C2, C1a and C1b are the shortest alignments from central Orange County to Oceanside. Options C3 and C4 are longer than C2 because they bypass parts of the alignment along I-5 in south central and southern Orange County.

Population & Employment Catchment

Station Evaluation/Comparison: The population and employment forecasts for the year 2020 that are listed in the table below are based on 10-mile (16 km) radii around each proposed station.

Station	2020 Population	2020 Employment
Irvine – LOSSAN	1,307,800	906,503
Irvine – I-5	1,618,714	1,149,916
Newport Beach	1,705,610	1,200,373
Oceanside – LOSSAN	458,045	259,653
Oceanside – I-5	507,306	273,692

Sources: Southern California Association of Governments 2020 Forecast;
San Diego Association of Governments 2020 Regional Growth Forecasts

B. MAXIMIZE CONNECTIVITY AND ACCESSIBILITY

Intermodal Connections

Station Evaluation/Comparison: Station locations being compared and evaluated in this section are those for southern Orange County and northern San Diego County. The station sites being evaluated include:

Options C1a/b; Irvine: The existing ITC is already a transit hub for southern Orange County. The ITC offers connections to various OCTA bus routes, and has connections to Amtrak and Metrolink trains. Air connections can be made at John Wayne Airport, 7.5 miles (12 km) to the west. The freeways and major arterials within a 1-mile (1.6 km) radius of this station are:

- I-5
- I-405
- SR-133
- Barranca Parkway
- Irvine Center Drive
- Alton Parkway

Option C2; Irvine: This station location would be at the I-5/ Jeffrey Road interchange in Irvine. Unlike the ITC, OCTA currently only has two bus routes that serve this area, and there are no existing rail connections. Air connections can be made at John Wayne Airport, 5.5 miles (8.8 km) to the southwest. The I-5 Freeway and SR-133 Freeway/Transportation Corridor are both within one-mile (1.6 km) of the station. The major arterials within a 1-mile (1.6 km) radius of the proposed site are:

- Jeffrey Road
- Irvine Center Drive
- Trabuco Road
- Sand Canyon Avenue

Option C3; Newport Beach: The proposed station site would be on SR-73 (San Joaquin Transportation Corridor) between Jamboree Road and University Drive. This location is already served by several OCTA bus routes, but has no existing rail lines or connections. This station is in close proximity to John Wayne Airport, which currently is the major commercial airport hub for Orange County. However, the site has limited arterial road access due to the proximity of SR-73. The freeway and major arterials within a 1-mile (1.6 km) radius of the proposed site are:

- SR-73
- Jamboree Road
- MacArthur Boulevard
- University Drive

There are two proposed station sites for north San Diego County, both of which are located in Oceanside.

Option C1a/b; Oceanside: This station site is at the existing Oceanside Transportation Center (OTC). This site provides easy access to existing public transit connections with several NCTD bus routes as well as the Amtrak Pacific Surfliner and both Metrolink and Coaster commuter services. This station is also the proposed western terminus for the Oceanside to Escondido LRT system. The closest commercial airport is the San Diego Airport (Lindbergh Field), located 34 miles (54.4 km) to the south. The freeway and major arterials within a 1-mile (1.6 km) radius of the proposed site are:

- I-5
- Pacific Coast Highway
- Mission Street
- Oceanside Boulevard

Options C2/C3/C4; Oceanside: This proposed station site is at the intersection of I-5 and Oceanside Boulevard, and is currently served by several NCTD bus routes. The proposed Oceanside - Escondido LRT system would pass by this location, creating an opportunity for a potential LRT stop. Like the OTC, this site is also isolated from major commercial airports. The closest commercial airport is the San Diego Airport, located 33 miles (52.8 km) to the south. The freeway and major arterials within a 1-mile (1.6 km) radius of the proposed site are:

- I-5
- Oceanside Boulevard
- Mission Street
- Pacific Coast Highway

C. MINIMIZE OPERATING AND CAPITAL COSTS

Length

Alignment Evaluation/Comparison: The lengths of the five alignment options are estimated to be:

Option C1a	Option C1b	Option C2	Option C3	Option C4
55.5 miles (89.3 km)	56.1 miles (90.3 km)	55.1 miles (88.6 km)	57.6 miles (92.7 km)	60.6 miles (97.5 km)

Options C2, C1a and C1b are the shortest alignments from central Orange County to Oceanside. Options C3 and C4 are longer than Option C2 because they bypass parts of the alignment along I-5 in south central and southern Orange County.

Operational Issues

Alignment Evaluation/Comparison:

Option C1a: Most of this option would follow relatively straight sections of track, but there are three curves with 50 mph (80 km/h) speed restrictions and many 75 mph (120 km/h) speed restrictions. These restricted areas include Orange Junction and Dana Point. The simulated trip times for this options were the longest for this segment. The proposed tunnel under San Juan Capistrano (in the current LOSSAN alignment) requires a 2 percent (approximate) transition to/from grade, which would slow freight operation in the corridor. This is a shared-used alignment and would be subject to some delay from other passenger and freight traffic.

Option C1b: This option follows most of the same alignment as Option C1a, but includes bypasses in the southern part of this alignment (C1b) to avoid some of these speed restrictions, resulting in slightly reduced simulated trip times. As with Option C1a, this is a shared-used alignment and would be subject to some delay from other passenger and freight traffic. Tunnels at San Juan Capistrano and San Clemente could divert HS/VHS trains around slower rail traffic on the existing alignment. (Diverting Metrolink traffic at those locations would skip two passenger stations and construction of replacement commuter stations would be in the bypass tunnels, which has not been assumed). The tunnels under Orange and Dana Point straighten curves to increase operating speeds. The tunnel transitions at Orange require a 2 percent (approximate) transition to/from grade, which could slow freight operation at that location.

Option C2: This option follows the median and shoulders of I-5, which has a relatively straight alignment through this segment. The length of the alignment is about the same as the C1a/C1b options, and the simulated trip times were very close. This alignment has one 50 mph (80 km/h) speed restriction and several 75 mph (120 km/h) speed restrictions. This is a dedicated VHS train option, and would not be subject to delays from other rail traffic.

Option C3: This option mostly follows the alignments of SR-73 and I-5, both with relatively straight alignments. This option has the second longest distance in this segment, but the shortest simulated trip times. There are no 50 mph (80 km/h) speed restrictions, however there are several 75 mph (120 km/h) restrictions. This option includes a tunnel through the San Joaquin Hills along SR-73, to avoid the 6% sustained highway grades, which would have caused seriously reduced speeds.

Option C4: This option follows the alignments of SR-241 and I-5, and has the longest distance and the second longest trip times. Due to moderately steep grades along the existing and proposed SR-241 alignment, this option would only be suitable for dedicated VHS or maglev operation.

Station Evaluation/Comparison: The Irvine LOSSAN (ITC) and Oceanside LOSSAN (OTC) stations would be shared with existing Metrolink or Coaster commuter service. Under Option C1b, there would be less delay than with Option C1a at these and all other Amtrak and Metrolink stations due to proposed bypass tracks. For the other alignment options, the proposed stations in Irvine, Newport Beach and Oceanside would be dedicated VHS train stations.

Construction Issues

Alignment Evaluation/Comparison:

Option C1a: This option follows the existing LOSSAN alignment, completing the double tracking, adding some grade separations, tunneling at San Juan Capistrano and grade separating the tracks in San Clemente. The proposed tunnel under the LOSSAN alignment at San Juan Capistrano would require immediate transitions to/from grade to cross the nearby San Juan Creek and Arroyo Trabuco at-grade, and new platforms and vertical access would be required to maintain Amtrak and Metrolink service at the Amtrak/Metrolink station. Staging construction within or adjacent to the existing LOSSAN alignment would be challenging due to the narrow width of the right-of-way and proximity of the historic station. The grade separation in San Clemente would involve one vehicle crossing at the pier and the main issue would be maintaining public access to the beach during construction.

Option C1b: This option is similar to Option C1a but includes tunnels for curve realignment and bypasses at sensitive areas. Realigning the Orange Junction Curve would require a tunnel for LOSSAN, plus lowering of part of the connecting line (Olive Subdivision) and below grade platforms at the existing Metrolink station in Orange. Tunnels are proposed under I-5 past San Juan Capistrano (to bypass the Metrolink station and historic area) and in Dana Point (to allow curve straightening). This option also includes a deep tunnel under I-5 (due to the steep rolling profile of the freeway) in San Clemente, from Avenida Pico to Christianitos Road. Due to the greater number and complexity of tunnels, this option is more difficult to construct than Option C1a.

Option C2: This option proposes aerial construction along I-5 from Anaheim to Dana Point, a tunnel through San Clemente, at-grade construction through Camp Pendleton, and aerial construction south of the Coaster Maintenance Facility (Stuart Mesa) through Oceanside. The same general issues discussed for freeway construction under Option A1 would apply to most of this alignment. For example, third level aerial construction is required along I-5 from the Anaheim to SR-55, due to numerous freeway and arterial overcrossings, and the carpool lane viaduct in the median south of the LOSSAN overcrossing. Third level aerial construction is assumed at interchanges with other freeways and highway, including SR-133, I-405 and SR-73. A tunnel is included under I-5 in San Clemente, from Las Ramblas to Christianitos Road, due to the rolling profile of the freeway. Third-level aerial construction is continuous through Oceanside due to the close spacing of arterial and local road overcrossings between the San Luis Rey River and Oceanside Boulevard.

Option C3: This alignment includes trench/tunnel construction next to the Santa Ana River Channel, and at-grade, tunnel and aerial construction along SR-73 and I-5. Construction along the Santa Ana River Channel is highly constrained by the channel, underground utilities in the levee, and overhead power lines. Third level aerial construction is required at several major interchanges: I-405/SR-73, SR-73/SR-55 and SR-73/I-5. The VHS train system must be in a trench in the median of SR-73 to pass beneath the John Wayne Airport glide path. Two long tunnel segments are required under SR-73, due to sustained 6 percent grades in the San Joaquin Hills, from Newport Beach to Mission Viejo. Option C3 has the same issues as C2 from San Juan Capistrano through San Clemente and Camp Pendleton through to Oceanside.

Option C4: From Anaheim to Irvine and San Onofre to Oceanside, this option would follow the same alignment as C2. Between Irvine and San Onofre his alignment would follow the SR-241 toll road, which has a rolling profile, requiring a tunnel section near Arroyo Trabuco. South of Oso Parkway, the alignment follows the proposed "Far East" alignment alternatives

for SR-241; the highway does not yet exist south of Oso Parkway. In this section, the alignment crosses several canyons and rivers, requiring long-span aerial construction. If the SR-241 were not built along the "Far East" alignment, the construction of this option would include substantial earthwork between Oso Parkway and San Onofre, which would otherwise be accomplished by the highway construction. Assuming that the SR-241 does follow this alignment, this option would have fewer construction issues than Options C2 and C3, but more than C1a and C1b.

Station Evaluation/Comparison: For Options C1a and C1b, the Irvine and Oceanside LOSSAN stations (ITC and OTC) are proposed expansions of existing stations, including bypass tracks, additional platforms and expanded parking.

The Irvine I-5 and Oceanside I-5 stations for Options C2 and C4 would be new aerial stations above the freeway and would be difficult to construct due to the freeway location. Freeway issues were discussed for Option A1.

The Newport Beach site (Option C3) is not ideal for a station, as it is located on a curve. It is not feasible to move the station west of Jamboree Road, as this would place it near the flight path for John Wayne Airport. The location is also challenging due to adjacent freeway on- and off-ramps from SR-73 for Jamboree Road and University Drive, and the San Diego Creek Channel would be under the station area. (Option C3 also includes the Oceanside I-5 station).

Capital Cost

Alignment Evaluation/Comparison: Capital cost estimates have been prepared using the unit rates defined in Task 1.5.2, with the exception of the adapted unit rates needed for LOSSAN Options C1a and C1b, as noted in Section 2.2.1. The preliminary capital cost estimates, were converted to the following ratings:

Option C1a	Option C1b	Option C2	Option C3	Option C4
Least Cost	Moderate	Very High	Highest Cost	Very High

Option C1a is considerably less expensive than the other options in this segment, as it includes areas requiring minimal construction (the tracks and grade separation are already sufficient for conventional HS). Option C1b includes bypass tunnels and trenches, and follows portions of I-5, resulting in a moderate cost, much greater than Option C1a. Relative to the other options, these are the least costly, between $1 billion and $2.5 billion less than the dedicated alignments.

Options C2 and C4 are estimated to have very high costs, due to long stretches of aerial construction and some tunneling in highway sections with rolling profile. Option C4 has less third-level aerial construction, due to fewer freeway interchanges and arterial highways, but is a longer alignment than C2.

Option C3 is estimated to have the highest cost, because it includes the most tunneling, which on average costs more per mile (or per km) than aerial or at-grade construction.

Station Evaluation/Comparison: Capital cost estimates are included within the alignments. At the screening level, the unit costs for stations are conceptual, based on the type of station being considered.

Stations at the ITC and OTC locations (Options C1a and C1b) are assumed somewhat less expensive than the Irvine I-5, Oceanside I-5 and Newport Beach locations (for Options C2, C3 and C4) because an Amtrak/Metrolink station already exists at these location, offsetting some of the capital costs of a new station.

Right-of-Way Issues/Cost

Alignment Evaluation/Comparison:

Option C1a: This alignment is mostly within the existing LOSSAN corridor, but would require some widening to complete a second main track and to construct a cut-and-cover tunnel under San Juan Capistrano.

Option C1b: This alignment is similar to Option C1a. Bypass segments in new right-of-way include tunnels under I-5 (San Juan Capistrano and San Clemente), and near Orange Junction Curve and Dana Point. These bypass segments would require right-of-way in heavily constrained areas in order to transition to a tunnel. The Orange Junction and Dana Point areas are also fully developed.

Option C2: The I-5 median is constrained from Anaheim to San Onofre, and in Oceanside. Through Camp Pendleton, the land outside the I-5 right-of-way is owned by the U.S. Department of the Navy. The Navy would have to review the use of the land to determine if it would be in conflict with Marine/Navy training exercises.

Option C3: The alignment along the SARC and I-405 is highly constrained. The alignment along SR-73 is less constrained, and much of the option would be in a tunnel under SR-73. from San Juan Capistrano to Oceanside, the issues are the same as for Option C2.

Option C4: The freeway median for this option is constrained along I-5 through Santa Ana, Tustin, and Irvine. The SR-241 median appears to be wide enough to accommodate a VHS train system. Through Camp Pendleton and Oceanside, the issues are the same as for Option C2.

Station Evaluation/Comparison: The Irvine and Oceanside LOSSAN stations would build upon the existing station site (ITC and OTC) and therefore require less net right-of-way than the I-5 dedicated options in some cities. The Newport Beach option is highly constrained by SR-73 to the north and residential development to the south.

D. MAXIMIZE COMPATIBILITY WITH EXISTING AND PLANNED DEVELOPMENT

Land Use Compatibility and Conflicts

Alignment Evaluation/Comparison:

Options C1a/b: Land uses along the proposed alignment are mixture of commercial, industrial, office space, and low-to medium-density residential. Agricultural land uses occur in portions throughout southern Orange County. The Edison International Field is located south of the LOSSAN on land designated as commercial recreation. The SARC is also located across this corridor and is designated open space. The U.S. Marine Corps Air Station (MCAS)

Tustin (closed) and MCAS El Toro (closed) are located adjacent to the existing rail corridor. Mission San Juan Capistrano and Historic Town Center Park are located adjacent to alignment Option C1a and within one-mile (1.6 km) of Option C1b.

Option C2: Land uses are generally similar to those described for Option C1a/b.

Option C3: Land uses are generally similar to those described for Option C1a/b. John Wayne Airport is located, adjacent to this option in central Orange County. Within southern Orange County, large segments of open space exist along the alignment. The area along the SR-73 toll road contains large tracts of residential development particularly in the cities of Laguna Niguel and Laguna Hills.

Option C4: The proposed alignment follows a toll highway through agricultural lands west of MCAS El Toro (closed). Large tracts of residential development occur in the cities of Lake Forest, Mission Viejo and Rancho Santa Margarita. The portion of SR-241 between Antonio Parkway and Oso Parkway is open space/preserve and is largely undeveloped immediately adjacent to the toll road. South of Oso Parkway, the option follows the proposed toll road alignment through largely undeveloped land. The alignment passes west of the General Thomas F. Riley Wilderness Park and just east of the Rancho Mission Viejo Ecological Reserve. Land uses in San Diego County are largely open space and recreational.

Station Evaluation/Comparison:

Options C1a/b; Irvine: Near the station area, the dominant land use is low-density business park/industrial and transportation. The closed MCAS El Toro is adjacent to the station and is currently planned for redevelopment either with a mix of residential, commercial and open space uses (proposed by Irvine); or as a commercial airport (proposed by Orange County). Intensification of business parks in the Irvine Spectrum is possible in the future. Implementation of a high-speed train station would be compatible with existing and future planned land uses.

Option C2; Irvine: The proposed station is in a developing area of Irvine. Residential land uses, considered as sensitive, are currently located to the north and west. Agricultural lands dominate the remainder of the station area at present. These lands are owned by The Irvine Company, which has plans to develop this area with approximately 12,000 residential units, 730,000 square feet of retail, and 6.5 million square feet of research and industrial facilities, and open space. Irvine is currently processing a pre-zone, General Plan Amendment and Zone Change for annexation of this development area. The Irvine Northern Sphere EIR has been initiated by Irvine for these lands, and is scheduled for completion in 2002.

Option C3; Newport Beach: The dominant land use in the area is open space including the Upper Newport Bay Ecological Preserve and Bonita Creek Park. Commercial and medium density residential land uses are also in the area surrounding the station site. The University of California, Irvine (UCI) campus is located approximately one mile (1.6 km) to the north. The park uses would be considered very sensitive.

Option C1a/b; Oceanside: The area surrounding the OTC includes a mix of transportation, commercial, residential, and recreation uses (Oceanside City Beach). The San Diego Association of Governments' (SANDAG) *2020 Regional Transportation Plan*[26] has identified transit centers in San Diego County as opportunity areas for future development that incorporates smart Growth principles.

[26] San Diego Association of Governments. *2020 Regional Transportation Plan.* April 2000.

Options C2/C3/C4; Oceanside: Mobile home parks dominate in the southwest quadrant of I-5 and Oceanside Boulevard, along with some single-family residential uses. Single-family residential uses dominate in the northwest and southeast station area. The Center City Golf Course occupies a large portion of the northeast quadrant of the I-5 and Oceanside Boulevard intersection, behind commercial uses fronting on Oceanside Boulevard. There are no vacant sites in the area that would accommodate a high-speed train station.

Visual Quality Impacts

Alignment Evaluation/Comparison:

Options C1a/b: Viewsheds within this option vary considerably from heavily urbanized areas of central Orange County to open space and farmlands along the LOSSAN and I-5 corridors through southern Orange County and Northern San Diego County. The Pacific Ocean to the west and foothills and suburban housing tracts to the east dominate views south of the San Juan Capistrano area. This option would have minor visual impacts to the surrounding communities because the majority of the alignment would be in an existing railroad corridor. No communities or neighborhoods would be adversely divided by the proposed alignment option.

Option C2: The existing viewshed for this alignment option is similar to that described for Option C1a and C1b. This option would have minor to moderate visual impacts to the surrounding communities because the majority of the alignment would be aerial in an existing freeway corridor, except in Camp Pendleton, where it is proposed to be at-grade. No communities or neighborhoods would be adversely divided by the proposed alignment option.

Option C3: South of SR-22, in Santa Ana, the SARC corridor is dominated by riparian vegetation and natural wildlife habitat. Urbanized areas of primarily residential and commercial development are located adjacent to this alignment along the SARC. The I-405 corridor is dominated by office and commercial development in the Irvine area. Much of the area along SR-73 is a mixture of suburban residential development and undeveloped areas of rolling hills with natural vegetation. The alignment option would have minor visual impacts to the surrounding communities because of the tunnels under the San Joaquin Hills and San Clemente. In other areas the alignment option would be aerial in a freeway alignment, but at-grade through Camp Pendleton. A large portion of the alignment would be trenched in the south Orange County and a portion of northern San Diego County. The remaining portions of northern San Diego County would be at-grade have minor impacts to visual quality. No communities or neighborhoods would be adversely divided by the proposed alignment option.

Option C4: The northern portion this option is located within the suburban residential and office areas of Tustin and Irvine. The alignment transitions to suburban residential development and then into undeveloped areas of rolling hills with natural vegetation to the south. The alignment option would have minor to significant visual impacts to the surrounding communities because the majority of the alignment option would be aerial on existing freeway alignments, along with open space in southern Orange County. Alignment portions of Camp Pendleton would be at-grade with a small portion being trenched. No communities or neighborhoods would be adversely divided by the proposed alignment option.

Station Evaluation/Comparison:

Options C1a/b; Irvine: The viewshed around the ITC includes the existing station, suburban residential and office developments. Undeveloped areas of rolling hills (San Joaquin Hills) to

the south are present. The Santa Ana Mountains can be viewed from the station to the northeast, including Santiago (Saddleback) Peak. The location of the station is such that it would allow for preservation of existing viewsheds.

Option C2; Irvine: The viewshed around this station site includes suburban residential and commercial developments, overhead electrical utilities, and I-5. Undeveloped areas of rolling hills (San Joaquin Hills) are present to the south. The Santa Ana Mountains can be viewed from the station to the northeast, including Santiago (Saddleback) Peak. The location of the station is such that it would allow for preservation of existing viewsheds.

Option C3; Newport Beach: The viewshed is dominated by riparian vegetation and natural wildlife habitat. Office, commercial, and suburban residential developments are also present in the area around the station. Visual quality is high in this location and the station could potentially have an adverse impact.

Options C1a/b; Oceanside: The viewshed around the OTC is dominated by the Pacific Ocean to the west. Residential, commercial, and recreational uses are also nearby. The landform is level in the station area.

Options C2/C3/C4; Oceanside: The viewshed around this station site is dominated by suburban residential development, I-5, and open space (Center City Golf Course). The topography ranges from flat to low rolling hills.

E. MINIMIZE IMPACTS TO NATURAL RESOURCES

Wetland Resources

Alignment Evaluation/Comparison:

Options C1a/b: There are 15 wetland and riparian areas that are known to occur within this option. These include the Santa Ana River Channel (SARC), Santiago Creek, Peters Canyon Wash, Borrego Canyon Wash, San Diego Creek, Aliso Creek, Oso Creek, Trabuco Creek, San Juan Creek, San Mateo Creek, San Onofre Creek, Horno Canyon Creek, Las Pulgas Canyon Creek, Santa Margarita River, and the San Luis Rey River.

Option C2: There are 17 wetland and riparian areas that are known to occur within this option. These include the SARC, Santiago Creek, El Modena Irvine Channel, Peters Canyon Wash, Borrego Canyon Wash, San Diego Creek, Aliso Creek, Oso Creek, Trabuco Creek, San Juan Creek, San Mateo Creek, San Onofre Creek, Horno Canyon Creek, Las Pulgas Canyon Creek, Santa Margarita River, and the San Luis Rey River.

Option C3: This option includes the wetland resources in Option C2, from Trabuco Creek to the San Luis Rey River. There are seven additional wetland and riparian areas known to occur within this option that are not described in Option C2. These include the Greenville Banning Channel, Paularino Channel, Santa Ana Delhi Channel, San Diego Creek Channel, Wood Canyon Creek, Aliso Creek, and Oso Creek.

Option C4: This option includes the same wetland resources as Option C2, since half of the alignment is the same. There are seven additional wetland and riparian areas known to occur within this option that are not described in Option C2. These include Upper Oso Reservoir, Trabuco Creek, Tijeras Canyon Creek, San Juan Lakes, Christianitos Creek, San Mateo Creek, and San Onofre Creek.

Station Evaluation/Comparison: There are no known wetland or riparian areas that would be impacted by the station sites at the ITC, Irvine I-5, or Oceanside I-5 stations. The Newport Beach station is in close proximity to Newport Back Bay, and expansion of the OTC could impact one or more wetland or riparian areas.

Water Resources

Alignment Evaluation/Comparison:

Options C1a/b: Major surface water resources crossed by this alignment option include the Santa Ana, Santa Margarita, and San Luis Rey Rivers. Other water resources crossed include 13 creeks: Coyote, Brea, Fullerton, Santiago, San Diego, Aliso, Oso, Trabuco, San Juan, San Mateo, San Onofre, Horno Canyon, and Las Pulgas Canyon. The channels crossed by the alignment include the Santa Fe and Bitterbush channels, Peters Canyon Wash, Borrego Canyon Wash, and a groundwater recharge basin at the terminus of Carbon Creek.

Option C2: Major surface water resources crossed by this alignment option include the Santa Ana, Santa Margarita, and San Luis Rey Rivers. Other water resources crossed include 12 creeks: Fullerton, Carbon, Crescent, Santiago, San Diego, Aliso, Oso, Trabuco, San Mateo, San Onofre, Horno Canyon, and Las Pulgas Canyon. Additional water resources crossed include the El Modena Irvine Channel, and Peters Canyon Wash.

Option C3: Major surface water resources crossed by this alignment option include the Santa Ana and Santa Margarita Rivers. Other water resources crossed include eight creeks: Wood Canyon, Aliso, Oso, Trabuco, San Mateo, San Onofre, Horno Canyon, and Las Pulgas Canyon. Additional water resources crossed include the channels of Greenville, Paularino, Santa Ana Delhi, and San Diego Creek.

Option C4: The major surface water resources crossed by this option are the same as Option C2. Other water resources crossed that differ from those listed in Option C2 include four creeks: Tijeras Canyon, Christianitos, San Mateo, and San Onofre. Additional water resources crossed include the San Juan Lakes, and Upper Oso Reservoir.

Station Evaluation/Comparison: There are no known water resources that would be impacted by any of the proposed stations at the ITC, OTC, Irvine I-5, and Oceanside I-5. The Newport Beach station would be adjacent to the San Diego Creek Channel.

Floodplain Impacts

Alignment Evaluation/Comparison:

Options C1a/b: A 100-year floodplain zone is crossed for approximately 150 feet (45.7 meters) near the beginning of this Option, northwest of the intersection of Main Street and Orangewood Avenue within the city of Orange. The LOSSAN corridor crosses another 100-year floodplain zone for approximately 1,850 feet (564.0 meters) between Red Hill Avenue and Culver Street and in Tustin. The LOSSAN corridor also crosses several 100-year floodplain zones associated with Trabuco and San Juan Creeks and several small creek drainages in San Clemente. The total length of floodplains crossed by this option would be approximately 2,000 feet (609.7 meters).

Option C2: I-5 crosses a 100-year floodplain zone for approximately 2,270 feet (692.1 meters) between Orangewood Avenue and SR-22 within the cities of Anaheim and Orange. The corridor also crosses a 100-year floodplain for approximately 120 feet (36.6 meters)

between Red Hill Avenue and Culver Street in Tustin. There are also a number of 100-year floodplain zones that are crossed in south Orange County that vary in size from 100 to 5,000 feet along I-5 corridor including Trabuco and San Juan Creeks.

Option C3: The 100-year floodplain zones that are crossed within this option are similar to those described above in Options C1a, C1b, and C2, only the floodplains are crossed in different locations.

Option C4: SR-241 crosses numerous 100-year floodplain zones and is associated with unnamed drainages, tributaries and small creeks. From Anaheim to Irvine and from San Onofre to Oceanside, the floodplains crossed are the same as for Option C2.

Station Evaluation/Comparison: There are no known impacts to any floodplains from any of the proposed stations along these alignments.

Threatened & Endangered Species Impacts

Alignment Evaluation/Comparison:

Options C1a/b: The following 27 threatened and endangered species and species of special concern are known to occur within this alignment option:

- San Fernando Valley Spineflower (Species of Special Concern)
- San Diego Horned Lizard (Species of Special Concern)
- Southern Sycamore Alder Riparian Woodland (Species of Special Concern)
- Intermediate Mariposa Lilly (Species of Special Concern)
- Arroyo Chub (Species of Special Concern)
- Coastal California Gnatcatcher (Threatened: Federal listing)
- Southern Cottonwood Willow Riparian Forest (Species of Special Concern)
- Coulter's Saltbush (Species of Special Concern)
- Tidewater Goby (Endangered: Federal listing)
- Monarch Butterfly (Species of Special Concern)
- Blochman's Dudleya (Species of Special Concern)
- Southern Coastal Salt Marsh. (Species of Special Concern)
- Least Bell's Vireo (Endangered: Federal and State listing)
- San Diego Fairy Shrimp (Endangered: Federal listing
- California Least Tern (Endangered: Federal and State listing)
- Aphanisma (Species of Special Concern)
- Many-Stemmed Dudleya (Species of Special Concern)
- Bank Swallow (Threatened: State listing)
- San Diego Mesa Hardpan Vernal Pool (Species of Special Concern)
- White-Tailed Kite (Species of Special Concern)
- Pendleton Button-Celery (Species of Special Concern)
- Northern Harrier (Species of Special Concern)
- Coastal Brackish Marsh (Species of Special Concern)
- Coast Wooly-Heads (Species of Special Concern)
- Pacific Pocket Mouse (Endangered: Federal listing)
- Belding's Savannah Sparrow (Endangered: State listing)
- Slender Wooly Head's (Species of Special Concern)

Option C1b includes several tunnels that would potentially reduce impacts to these species.

Option C2: The threatened and endangered species and species of special concern known to occur within this alignment are the same as described for Options C1a and C1b.

Option C3: The following seven threatened and endangered species and species of special concern are known to occur within this alignment option along the SARC and SR-73:

- Southern Tarplant (Species of Special Concern)
- Coastal California Gnatcatcher (Threatened: Federal listing)
- Light-Footed Clapper Rail (Endangered: Federal and State listing)
- Southern Coast Live Oak Riparian Forest (Species of Special Concern)
- Coastal Cactus Wren (Species of Special Concern)
- Laguna Beach Dudleya (Threatened: Federal and State listing)
- Orange-Throated Whiptail (Species of Special Concern)

Option C4: The following 21 threatened and endangered species and species of special concern are known to occur within this alignment option along the SR-241:

- Coastal Cactus Wren (Species of Special Concern)
- Coastal California Gnatcatcher (Threatened: Federal listing)
- Western Spadefoot (Species of Special Concern)
- Orange-Throated Whiptail (Species of Special Concern)
- Riverside Fairy Shrimp (Endangered: Federal listing)
- San Diego Horned Lizard (Species of Special Concern)
- Southern Sycamore Alder Riparian Habitat (Species of Special Concern)
- Valley Needle Grass Grassland (Species of Special Concern)
- Pallid Bat (Species of Special Concern)
- Southern Mixed Riparian Forest (Species of Special Concern)
- Long-Eared Owl (Species of Special Concern)
- Southern Cottonwood Willow Riparian Woodland (Species of Special Concern)
- Southern Tarplant (Species of Special Concern)
- Many-Stemmed Dudleya (Species of Special Concern)
- Arroyo Chub (Species of Special Concern)
- Payson's Jewel-Flower (Species of Special Concern)
- Arroyo Toad (Endangered: Federal listing)
- Thread-Leaved Brodiaea (Threatened: Federal, Endangered: State listing)
- Tidewater Goby (Endangered: Federal listing)
- Least Bell's Vireo (Endangered: Federal and State listing)
- Southern Foredunes (Species of Special Concern)

Station Evaluation/Comparison: There are no known threatened or endangered species or species of special concern that occur in the vicinity of the Irvine station options. However, the Coast Wooly-Head is known to occur within the vicinity of the station options in Oceanside, and the Coastal California Gnatcatcher and the Light-Footed Clapper Rail is known to occur within the vicinity of the proposed station in Newport Beach.

F. MINIMIZE IMPACTS TO SOCIAL AND ECONOMIC RESOURCES

Environmental Justice Impacts (Demographics)

Alignment Evaluation/Comparison:

Options C1a/b: Minority populations that are potentially affected by this option were identified in several 1990 Census block groups in the cities of Anaheim, Orange, Santa Ana,

Tustin, and San Juan Capistrano. The minority population potentially affected within these block groups was estimated to be approximately 17,275 people. No low-income households were identified in the cities along this alignment option.

Option C2: Minority populations that are potentially affected by this option were identified in several 1990 Census block groups in the cities of Anaheim, Orange, Santa Ana, Tustin, and San Juan Capistrano. The minority population potentially affected within these block groups was estimated to be approximately 13,700 people. No low-income households were identified in the cities along this alignment option.

Option C3: No minority populations that are potentially affected by this option were identified in any of the cities along this alignment option. No low-income households were identified in the cities along this alignment option.

Option C4: Minority populations that are potentially affected by this option were identified in several 1990 Census block groups in an unincorporated portion of Orange County. The minority population potentially affected within these block groups was estimated to be approximately 50 people. No low-income households were identified in the cities along this alignment option.

Station Evaluation/Comparison: There is a potential impact to known minority populations of approximately 300 people in proximity to the Oceanside stations. There are no known impacts to any minority populations or low-income households in proximity to any of the other proposed stations within this alignment option.

Community and Neighborhood Impacts

Alignment Evaluation/Comparison:

Options C1a/b: From Anaheim, the proposed alignment follows the existing OCTA Metrolink rail corridor through the cities of Orange, Santa Ana, Tustin, Irvine, Lake Forest, Mission Viejo, Laguna Hills, Laguna Niguel, San Juan Capistrano, Dana Point, San Clemente, and the community of El Toro (Lake Forest). The MCAS Tustin (closed) and MCAS El Toro (closed) are located adjacent (south and north respectively) to the existing LOSSAN corridor. Option C1a follows the existing corridor with some widening, and a tunnel through San Juan Capistrano. The alignment continues into San Diego County along the San Diego Northern Railway (SDNR). This portion along the coast primarily travels between recreational areas (state beach) and U.S. Marine Corps Base at Camp Pendleton. Upon exiting Camp Pendleton, the proposed alignment enters Oceanside between Oceanside Harbor and I-5.

Within Option C1a, there is a potential for a minor physical barrier within the communities and neighborhoods of south Orange County because the alignment would follow and existing railroad corridor that parallels the communities along the coast.

Option C1b also includes bypass alignments at San Juan Capistrano and San Clemente where the alignment would deviate away from the LOSSAN corridor and into the I-5 alignment to avoid sensitive areas. Although these would be tunnel configurations, the possibility exists for community disruption at the tunnel transitions.

Option C2: This alignment option continues through Orange County along I-5 through and adjacent to the cities of Anaheim, Orange, Santa Ana, Tustin, Irvine, Laguna Hills, Laguna Woods, Mission Viejo, Laguna Niguel, San Juan Capistrano, Dana Point, San Clemente; and unincorporated areas of Orange County. In San Diego County, this option parallels

recreational areas (state beach), passes by the San Onofre Nuclear Power Plant Facility, and continues through the U.S. Marine Corps Base at Camp Pendleton. Upon departing Camp Pendleton the proposed alignment follows I-5 entering Oceanside. This option would not cause any new physical barriers or divisions within the communities and neighborhoods listed because the alignment would follow an already existing freeway corridor.

Option C3: This option follows the SR-73 toll road through and adjacent to the cities of Costa Mesa, Newport Beach, Irvine, and the community of Santa Ana Heights (County of Orange). East of the San Diego Creek Channel, this alignment passes between UCI and residential areas in Newport Beach. South of Bonita Canyon Road, the alignment crosses undeveloped portions of the county. Residential growth and development are occurring adjacent to SR-73. The alignment traverses the Laguna Coast Wilderness Park and Aliso and Wood Canyons Wilderness Park (Laguna Beach). The proposed alignment then enters Aliso Viejo. The alignment continues through the eastern portion of Aliso and Wood Canyons Wilderness Park, and between the cities of Laguna Niguel and Laguna Hills. The alignment meets I-5 corridor in the vicinity of Avery Parkway where the cities of Laguna Niguel, Mission Viejo, and San Juan Capistrano converge. South of Avery Parkway, this alignment is the same as Option C2. This option would not cause any new physical barriers or divisions within the communities and neighborhoods listed because the alignment would follow existing freeway corridors.

Option C4: This alignment is the same as Option C2 from Anaheim to Irvine and from San Onofre to Oceanside.

From Irvine, this alignment follows SR-133 north and intersects SR-241 north of MCAS El Toro. The alignment continues through the cities of Lake Forest, Mission Viejo, Rancho Santa Margarita, and O'Neill Regional Park. The portion of SR-241 between Antonio Parkway and Oso Parkway is open space/preserve and is largely undeveloped immediately adjacent to the toll road. From the intersection with Oso Parkway the alignment continues along the proposed continuation of the SR-241. It traverses largely undeveloped land within the Orange County including Rancho Trabuco and Rancho Mission Viejo. The alignment passes west of the General Thomas F. Riley Wilderness Park, crosses SR-74, and passes just east of the Rancho Mission Viejo Ecological Reserve. It enters the County of San Diego just past Avenida Pico. This portion of the alignment traverses through San Onofre State Beach west of U.S. Marine Corps Base Camp Pendleton. The proposed SR-241 alignment terminates at the I-5/Basilone Road interchange, near San Onofre. This option would not cause any new physical barriers or divisions within the communities and neighborhoods listed because the alignment would follow existing or proposed transportation corridors.

If the SR-241 did not follow the "Far East" alignment alternative, this option would cross through open space planned for residential development, and could potentially form a barrier.

Station Evaluation/Comparison: For the Irvine station options, the City of Irvine would be the only community to be impacted by the proposed stations. Newport Beach would be affected by the proposed station location in that city. For the Oceanside station options, Oceanside is the only city or community affected.

Farmland Impacts

Alignment Evaluation/Comparison:

Options C1a/b: Prime farmland is located both east and west of the LOSSAN corridor in Tustin and Irvine near Harvard Avenue. Parcels of prime, unique and farmlands of statewide importance are located in the vicinity of Sand Canyon Avenue in Irvine. Prime farmland is also located in proximity to the convergence of the LOSSAN corridor and I-5 in San Juan Capistrano and at Stuart Mesa Road in Camp Pendleton.

Option C2: Parcels of prime farmland and farmlands of statewide importance are located east and west of I-5 between Jamboree Road and Culver Drive in Tustin. Prime farmlands occur east and west of I-5 south of Jeffrey Road in Irvine and unincorporated Orange County. Parcels of unique farmland are located south/southwest of the I-5 and LOSSAN corridors near Laguna Road. Prime farmland is also located in proximity to the convergence of the LOSSAN corridor and I-5 in San Juan Capistrano. I-5 is located south of a parcel of prime farmland south of the Orange/San Diego County border and bisects farmlands of local importance located within Camp Pendleton. Prime farmland is located at Stuart Mesa Road in Camp Pendleton.

Option C3: A parcel of farmland of statewide importance is located north of I-405 between Fairview Road and Harbor Boulevard west of SR-73. No additional parcels of prime or unique farmland or farmland of statewide importance occur within the SR-73 corridor between I-405 and I-5. The farmland impacts would be the same as Option C2 from San Juan Capistrano to Oceanside.

Option C4: From the current terminus of SR-241 at Oso Parkway south to SR-74 there are scattered parcels of prime and unique farmlands and farmlands of statewide importance. From SR-74 south to San Onofre there are parcels of prime farmlands and farmlands of statewide importance located south of Christianitos Road in unincorporated San Diego County. Farmland impacts would be the same as Option C2, from Anaheim to Irvine and San Onofre to Oceanside.

Station Evaluation/Comparison: No impacts would occur to known prime or unique farmland or farmlands of statewide importance from the proposed Newport Beach or Oceanside station options. Impacts to prime or unique farmland are possible, however, by the proposed Irvine I-5 station site.

G. MINIMIZE IMPACTS TO CULTURAL RESOURCES

Cultural Resources Impacts

Alignment Evaluation/Comparison:

Options C1a/b: Several cultural or historic sites occur west of the LOSSAN corridor in Santa Ana; however, they appear to be located beyond the study area. Two historic sites are located adjacent to and southwest of the LOSSAN corridor at Sand Canyon Avenue north of the merge with I-5. The San Juan Capistrano Mission and Los Rios Historic Districts are located in close proximity to the LOSSAN corridor at the SR-74 intersection. Two historic properties are located west of the LOSSAN corridor in San Clemente at the Avenida Rosa intersection. Several know sites occur east of the corridor at the Las Pulgas intersection on Camp Pendleton.

Option C2: Because I-5 and LOSSAN alignments are in proximity to one another in this option, cultural or historic resources for the LOSSAN alignment and stations within this option are the same as described in Option C1a-b.

Option C3: No known cultural or historic sites occur along the SARC or SR 73 within the study area or at the proposed station in Newport Beach. Known cultural or historic sites along I-5 were described in Options C1a and C1b. After this option joins I-5, the alignment has the same impacts as Option C2.

Option C4: There are no known cultural or historic resources along this alignment, other than those described in Option C2.

Station Evaluation/Comparison: No known cultural resource impacts are known to occur from the proposed stations in Irvine or Newport Beach. There is one known cultural resource impact however, that occurs in the immediate vicinity of the Oceanside station options.

Parks & Recreation/Wildlife Refuge Impacts

Alignment Evaluation/Comparison:

Options C1a/b: The following 23 parks and recreation resources are known to occur within or along this option.

- Santiago Park
- Flagstone Park
- Hoeptner Park
- The Meadows
- Oak Creek Golf Course
- Marine Memorial Golf Course
- Lake Forest Golf and Practice Center
- El Toro Park
- Bart Spendlove Memorial Park
- Rio Oso Park
- El Camino Real Park
- Descanso Veterans Park
- Doheny State Beach, Capistrano Beach County Park
- Prima Deshecha Canada Beach
- Ole Hanson Beach Club
- San Onofre State Beach
- Buccaneer Beach Park
- Lions Club Park

(The Parks and Refuges listed below would only be affected by Option C1a)

- Linda Lane Park
- Parque Del Mar
- Leslie Park
- Calafia Park
- San Clemente State Beach

Option C2: The following two parks and recreation resources are known to occur within or along this option.

- Bellis Park
- Bacon House Park

Option C3: The following seven parks and recreation/wildlife refuge resources are known to occur within or along this option.

- Moon Park
- Gisler Park
- Newport Beach Golf Course
- Bonita Creek Park
- Laguna Coast Wilderness Park
- Aliso & Wood Canyons Wilderness Park
- Springdale Park

Option C4: The following two parks and recreation resources are known to occur within or along this option.

- O'Neill Regional Park
- San Onofre State Beach

Station Evaluation/Comparison: There are no known parks or recreation/wildlife refuge resources that occur in the immediate vicinity of the Irvine or Oceanside station options. An impact to the Newport Beach Golf Course does occur due to its proximity to the proposed station location in Newport Beach.

H. MAXIMIZE AVOIDANCE OF AREAS WITH GEOLOGIC AND SOILS CONSTRAINTS

Soils/Slope Constraints

Alignment Evaluation/Comparison: There are nine distinct soil types within all the alignment options for this segment. Throughout southern Orange County, all the alignments traverse areas subject to liquefaction and earthquake induced slides. The liquefaction zone extends eastward into the Cleveland National Forest.

Portions of Option C4 south of the existing SR 241 terminus would be subject to slides and liquefaction in areas of cut slopes.

Station Evaluation/Comparison: One soil type is identified for the proposed Irvine stations as well as for the proposed Oceanside stations. The potential for liquefaction does occur for the Irvine stations. Some areas of potential liquefaction occur in the vicinity of the proposed Newport Beach station. One soil type is identified for this station as well.

Seismic Constraints

Alignment & Station Evaluation/Comparison: The Newport-Inglewood fault is an active seismic area and fault that is known to occur within the vicinity of each alignment and station option in this segment. There are no alignments or stations that cross or are located on these faults.

I. MAXIMIZE AVOIDANCE OF AREAS WITH POTENTIAL HAZARDOUS MATERIALS

Hazardous Materials/Waste Constraints

Alignment Evaluation/Comparison:

Options C1a/b: Several hazardous material/waste sites are located along the LOSSAN corridor with the greatest concentrations occurring in the cities of Santa Ana and Tustin. These sites are most likely associated with railroad operation and maintenance activities. One site is located adjacent to the corridor in San Clemente near Avenida Presidio. There are no known hazardous material/waste sites located along this alignment south of the San Clemente.

Option C2: Known hazardous material/waste sites occur adjacent to I-5. The hazardous material/waste sites include two in Anaheim, one in Tustin and two in Irvine. One site is located adjacent to I-5 in Mission Viejo. There are no known sites located along this alignment south of Mission Viejo.

Options C3/C4: There are no known hazardous material/waste sites are known to occur along SR-73, the SARC, or the SR-241 Toll Corridor.

Station Evaluation/Comparison: There are no known hazardous material/waste sites in the vicinity of the proposed Irvine or Newport Beach stations. There is one known hazardous material/waste site located in the immediate vicinity of the both Oceanside station locations.

4.1.4 Segment D – Oceanside to San Diego

This segment includes three alignment options (described in Section 3.4.4):

- Option D1a – LOSSAN Corridor with Tunnel at University City
- Option D1b – LOSSAN Corridor with Tunnel Under I-5
- Option D2 – Interstate 5 Freeway

Station options include:

- Solana Beach (LOSSAN) – *Serves Amtrak and Coaster; Options D1a and D1b*
- Solana Beach (I-5) – *Option D2*
- University Towne Centre (UTC) – *Option D1a*
- San Diego Airport – *Options D1b and D2*
- Santa Fe Depot – *Options D1a and D1b*

The evaluation of Segment D is described in the rest of Section 4.1.4. Tables 4.1-10 and 4.1-11 summarize the alignment and station options.

A. MAXIMIZE RIDERSHIP/REVENUE POTENTIAL

Travel Time

Alignment Evaluation/Comparison:

The table below lists estimated travel times (in minutes) for each alignment. A two-minute dwell time has been assumed at each station along the alignment.

Option D1a –	*Local*	*Express*
1. OTC	0	0
2. Solana Beach	10.8	
3. UTC	19.4	
4. Santa Fe Depot	30.9	24.5

Option D1b –	*Local*	*Express*
1. OTC	0	0
2. Solana Beach	10.0	
3. Santa Fe Depot	27.1	23.2

Option D2 –	*Local*	*Express*
1. Oceanside (I-5)	0	0
2. Solana Beach (I-5)	10.8	
3. San Diego Airport	24.3	21.4

The difference in times between options derives in part from the southern terminus location in San Diego. The proposed San Diego Airport station (Option D2) is 1.9 miles (3.04 km) further north than the Santa Fe Depot (Options D1a and D1b). Option D1b is faster than D1a because it is a more direct alignment and makes one fewer local stop.

Length

Alignment Evaluation/Comparison: The lengths of the three alignment options are based on preliminary alignments drawn using aerial photography.

Option D1a	Option D1b	Option D2
37.3 miles (60.0 km)	35.8 miles (57.7 km)	33.8 miles (54.5 km)

Option D2 is shorter for two reasons: it is more direct through Miramar Hill; and it terminates north of downtown San Diego at Washington Street, the assumed site for an Airport station.

Population & Employment Catchment

Station Evaluation/Comparison: The population and employment forecasts for the year 2020 that are listed in the table below are based on 10-mile radii around each proposed station.

Station	2020 Population	2020 Employment
Solana Beach – LOSSAN	496,489	305,176
Solana Beach – I-5	560,328	348,080
University Towne Centre	888,420	549,639
Santa Fe Depot	1,262,755	661,334
San Diego Airport	1,311,449	698,369

Source: San Diego Association of Governments 2020 Regional Growth Forecasts

B. MAXIMIZE CONNECTIVITY AND ACCESSIBILITY

Intermodal Connections

Station Evaluation/Comparison: Station locations being compared and evaluated in this section are those for Central San Diego County and the Downtown and Airport area. The station sites being evaluated in the central county are:

Options D1a/b; Solana Beach: The existing station is currently served by two NCTD bus transit routes and also by Amtrak's Pacific Surfliner and the Coaster commuter train. The nearest commercial airport is the San Diego Airport (Lindbergh Field) 17 miles (27.2 km) to the south. The freeway and major arterials within a 1-mile radius of this station are:

- I-5
- Lomas Santa Fe Drive
- Coast Highway 101
- Via De La Valle

Option D2; Solana Beach: This proposed station site would be located at the I-5/Lomas Santa Fe Drive interchange. One local NCTD bus route currently serves this area, and an express bus route currently operating on I-5 could potentially stop at this location. There are no existing rail lines or connections near the site, making the station difficult to access except by car. Like the existing LOSSAN station, the nearest major commercial airport is the San Diego Airport in downtown, located 17 miles (27.2 km) to the south. The freeway and major arterials within a 1-mile (1.6 km) radius of the proposed site are the same as for the existing Solana Beach station.

Option D1a; University Towne Centre: This proposed station is not currently on the LOSSAN corridor. The station would be in a tunnel, near the intersection of La Jolla Village Drive and Genesee Avenue, next to the University Towne Centre (UTC) Shopping Center in University City. Currently UTC is a major transportation hub for both MTDB and NCTD bus routes, providing access to the area from various locations around the city and county. No rail lines or connections currently exist, however, the MTDB has plans to extend the San Diego Trolley from Old Town to UTC. If the LOSSAN corridor were re-routed through a tunnel under Miramar Hill and this station was constructed, both Amtrak and Coaster would serve this station. The closest commercial airport connection is made the San Diego Airport 9.5 miles (15.2 km) to the south. The freeways and major arterials within a 1-mile (1.6 km) radius of the proposed site are:

- I-5
- I-805
- La Jolla Village Drive
- Genesee Avenue
- Nobel Drive

In the San Diego Airport and downtown region, two stations are proposed. Both provide connections to existing transit, rail, and highways.

Option D2; San Diego Airport: The station location for this site would be located at the I-5/Washington Street interchange. Several MTDB bus routes currently serve the area, as does the San Diego Trolley, which stops at Washington Street. This provides easy access to the Santa Fe Depot in downtown or the Old Town Transit Center, where connections to the Amtrak Pacific Surfliner or Coaster commuter train can be made. This station also offers easy access to the San Diego Airport terminals, located 1 mile (1.6 km) southwest of this site. The freeway and major arterials within a 1-mile (1.6 km) radius of the proposed site are:

- I-5
- Pacific Highway
- Washington Street

Option D1a/b; Santa Fe Depot: The area around the existing station is already a major transit hub for San Diego. Public transit connections can be made across Kettner Boulevard at the America Plaza, which is a major MTDB transit hub. Rail connections that are currently provided at the station include the Amtrak Pacific Surfliner, Coaster commuter train, and the San Diego Trolley. Easy access to the San Diego Airport, only 1.5 miles (2.4 km) to the northwest, is also available. The freeway and major arterials within a 1-mile (1.6 km) radius of the proposed site are:

- I-5
- Harbor Drive
- Pacific Highway
- Broadway

C. MINIMIZE OPERATING AND CAPITAL COSTS

Length

Alignment Evaluation/Comparison: The lengths of the three alignment options are based on preliminary alignments drawn using aerial photography.

Option D1a	Option D1b	Option D2
37.3 miles (60.0 km)	35.8 miles (57.7 km)	33.8 miles (54.5 km)

Options D1b and D2 are shorter for two reasons: they are more direct through Miramar Hill/University City; and, they terminate north of downtown San Diego at Washington Street, the assumed site for the airport station.

Operational Issues

Alignment Evaluation/Comparison:

Option D1a: This option is the longest in this segment and therefore has the longest simulated trip times. This is a shared-use option and delays due to freight and other passenger rail traffic would be a factor.

Option D1b: The D1b Option is shorter and has only one 50 mph (80 km/h) speed restriction and several 75 mph (120 km/h) speed restrictions. The simulated trip time is substantially shorter. This option has a more direct alignment than D1a, and includes bypass tracks at stations, which would improve reliability relative to Option D1a.

Option D2: Option D2 is a dedicated VHS option following the I-5 Freeway. The alignment has many 75 mph (120 km/h) speed restrictions.

Construction Issues

Alignment Evaluation/Comparison:

Option D1a: This option includes completion of double tracking (at-grade), construction on the Del Mar Bluffs, and a new tunnel under Miramar Hill. Substantial ground stabilization and reinforcement (long-term shoring) is assumed to accommodate two tracks along the Del Mar Bluffs. This would have to be investigated in detail to assess its feasibility. A deep tunnel is included under Miramar Hill from Sorrento Valley to Rose Canyon, which passes under Genesee Avenue but also under private property. The depth of the tunnel and proximity of the Rose Canyon Fault make this tunnel a serious construction challenge. In addition, the tunnel may have to be sufficiently wide to accommodate a second high-speed train alignment from Los Angeles to San Diego through the Inland Empire.

Option D1b: This option includes grade separation of a double-tracked system through the beach cities and downtown San Diego, and tunnels to bypass Del Mar and Miramar Junction. Proposed trench construction in the coastal cities would require transitions to and from grade to make each lagoon crossing, and some below grade platforms would be required at Coaster commuter stations, similar to Solana Beach, where grade separation of the alignment is proposed. A tunnel under Camino Del Mar is assumed as a default alignment to bypass the unstable bluff area; this tunnel would be under the main tourist/commercial area of Del Mar and staging of traffic on the highway will be difficult during construction. A tunnel under is

included deep under Miramar Hill, following I-5 alignment from north of Sorrento Valley Coaster to vicinity of Gilman Drive interchange. For this option, numerous grade crossings would be converted to trench overcrossings in the coastal cities and downtown San Diego. One location that appears to be challenging is Taylor Street, next to Old Town Transportation Center and I-5. South of I-5 in San Diego, the alignment is below grade due to closely spaced city streets, adjacent buildings, and proximity of the runway at San Diego Airport.

Option D2: Aerial construction is assumed along I-5, with third-level structures to clear arterial overpasses and freeway interchanges. To avoid constructing a tunnel in the Miramar Hill region (the highway climbs at an average of 3.3 percent on the north side), the alignment would climb to a higher structure at the I-805 interchange. It would remain on high structures to clear the arterial highway overcrossings along I-5 from I-805 to Gilman Drive. (The feasibility of doing this is being checked; a tunnel would be the default profile).

Station Evaluation/Comparison: The Solana Beach LOSSAN station would be simplest to construct for Option D1a, involving extension of the platforms, station facilities and parking. For Option D1b, bypass tracks are proposed but the alignment is constrained by the recently trenched station platforms and tracks. At the Santa Fe Depot in San Diego, the station would be expanded at-grade for Option D1a, while Option D1b has below-grade tracks and would require new platforms below the existing ones used by Amtrak and Coaster. The UTC station (Option D1a) would be in a tunnel and therefore most challenging to construct.

The Solana Beach I-5 and San Diego Airport stations would have aerial platforms above I-5. Both stations would be new and have construction staging issues due to the freeway, and therefore have more construction issues than the LOSSAN locations for options D1a/D1b.

Capital Cost

Alignment Evaluation/Comparison: Capital cost estimates have been prepared using the unit rates defined in Task 1.5.2, with the exception of the adapted unit rates needed for LOSSAN Options D1a and D1b, as noted in Section 2.2.1.

The preliminary capital cost estimates, not including vehicles or vehicle maintenance/storage facilities, are:

Option D1a	Option D1b	Option D2
Least Cost	Highest Cost	Very High

Option D1a has the lowest cost of the three options, because the major cost items are the tunnel under Miramar Hill and construction of stations at UTC and the Santa Fe Depot in downtown San Diego. Option D1a is estimated to cost about $1.2 billion less than the other options

Options D1b and D2 have similar costs. Option D1b assumes mostly trench or tunnel construction, plus numerous grade separations of crossing streets. Option D2 involved mostly aerial construction of a new alignment. It is important to note that while the costs are similar, Option D2 is shorter because it stops over two miles north of downtown San Diego, and the profile assumed for Option D2 would not lend itself to shared-use operations (for example, steep grades at Miramar Hill), leaving freight traffic on the LOSSAN corridor.

Station Evaluation/Comparison: Capital cost estimates for stations are included within the alignments. At the screening level, the unit costs for stations are conceptual, based on the type of station being considered.

A station in the tunnel under UTC (Option D1a) is assumed double the cost of a Solana Beach I-5 station, due to the expense of underground construction. A station already exists at Solana Beach – LOSSAN, offsetting some of the cost of building a high-speed train station.

A station at the San Diego Santa Fe Depot location is assumed somewhat less expensive than the San Diego Airport location because a large Amtrak/Coaster station already exists at the location, offsetting some of the capital costs of a new station.

Right-of-Way Issues/Cost

Alignment Evaluation/Comparison:

Options D1a/b: Follows the existing LOSSAN Corridor, with some widening, except for the new tunnel alignments under Miramar Hill (beneath Genesee Avenue and I-5, respectively).

Option D2: Follows I-5, which has a narrow median and development along much of the alignment, particularly south of I-805 interchange.

D. MAXIMIZE COMPATIBILITY WITH EXISTING AND PLANNED DEVELOPMENT

Land Use Compatibility and Conflicts

Alignment Evaluation/Comparison:

Options D1a/b: Land uses within this option are a mixture of agricultural, residential, and commercial. Numerous state beaches and parks are also located adjacent to the alignment. Designated open space is located along the corridor in lagoon areas. Land uses for the Oceanside, Solana Beach, and UTC station sites are a mixture of residential, commercial, office space, with some areas of open space, transportation, and recreational uses. Land uses for the proposed station at the San Diego Airport and the Santa Fe Depot in San Diego are common to heavy urbanized downtown areas with a mixture of residential, commercial, industrial, office space, and transportation centers.

Option D2: Land uses within this alignment and stations options are similar to those described for Options D1a/b.

Station Evaluation/Comparison:

Options D1a/b; Solana Beach: The area surrounding the station has a mix of low intensity commercial uses on either side of North Coast Highway 101 with single-family and multi-family residential properties behind the commercial uses. The beach parks are located to the west within walking distance of the station. Due to the proximity of the coast, large-scale development would not likely occur here in the future. However, a limited amount of intensification might be possible in conjunction with a high-speed train station.

Option D2; Solana Beach: To the east of I-5 are: the Lomas Santa Fe Country Club and associated single-family residential development; the San Elijo Lagoon County Park and Ecological Reserve, and San Dieguito County Park. Single family residential and a continuation of the Lagoon are located in the northwest quadrant of I-5/Lomas Santa Fe Drive. Retail commercial, the Santa Fe Christian Community High School and a junior high school are located in the southwest quadrant. Placement of a station in this area would encroach on some of these existing uses.

Option D1a; University Towne Centre: The station area is characterized by a mix of land uses including the retail UTC shopping mall; high-rise office developments along Genesee and the north side of La Jolla Village Drive; and medium density residential uses. A high-speed train station would enhance the mixed-use nature of this area and could provide improved linkages between surrounding developments.

Options D1b/D2; San Diego Airport: This station would be located near Washington Street adjacent to Lindbergh Field in San Diego. It would not provide a direct connection to the existing airport passenger terminal; however, the system might provide access to a potential new terminal at the airport.

Option D1a/b; Santa Fe Depot: Land uses surrounding the historic Santa Fe Depot include: transportation, hotel, surface parking, and high-rise office developments. Some vacant lands exist to the west of the station that might provide some opportunities for station area development.

Visual Quality Impacts

Alignment Evaluation/Comparison:

Options D1a/b: From Oceanside south, much of the LOSSAN and I-5 viewsheds are dominated by the Pacific Ocean to the west. South of Camp Pendleton, the viewshed is a mix of suburban residential and commercial development; farmland, and open space. There are several water features and natural habitat areas associated with lagoons and upland drainages. The southern viewshed of both routes are dominated by mixed residential, commercial, industrial development and open space. The views associated with the Oceanside, Solana Beach, and the University Towne Centre stations exhibit areas of mixed residential, commercial, office space, transportation corridors, open space and natural habitats. The alignment option would have minor to significant visual impacts to the surrounding communities because the majority of the alignment option would be at-grade in an existing railroad corridor. Other portions of the alignment would be below grade or tunneled under Del Mar and Univerity City. No communities or neighborhoods would be adversely divided by the proposed alignment option.

The potential trench and tunnel bypass sections of Option D1b would result in fewer visual impacts than Option D1a, however, electrification would create a new impact.

Option D2: The viewshed for this alignment and station options are similar to those described for Option D1a/b. This option would introduce an aerial structure into the freeway corridor and block ocean views from the east in certain areas, such as lagoon crossings. The alignment option would have minor visual impacts to the surrounding communities because the majority of the alignment option would be aerial in an existing freeway corridor. No communities or neighborhoods would be adversely divided by the proposed alignment option.

Station Evaluation/Comparison:

Solana Beach LOSSAN – The viewshed to the Pacific Ocean from the station area is currently interrupted by commercial and residential developments. The station would have a possible low adverse impact for residents due to its scale. The visual quality is good in the area.

Solana Beach I-5 – This area has a high quality visual environment with views of the Pacific Ocean, San Elijo Lagoon and San Dieguito County Park. The station would be viewed by

surrounding residents and would have an adverse impact. The topography ranges from flat to rolling hills.

University Towne Centre – There are low hills and level landform in this area. There is a high quality of landscaping scattered throughout the residential, commercial and high-rise office developments. The station could be integrated into the developed area with minimal visual impact.

San Diego Airport – The viewshed in this area is dominated by the San Diego Airport, rail lines, urban infrastructure, and industrial development. The station would provide an opportunity to improve the visual quality of the area.

Santa Fe Depot – The viewshed surrounding the historic Santa Fe Depot include: transportation, hotel, surface parking, and high-rise office developments. Careful design consideration will need to be applied to this station area in order to preserve the historic integrity of the Santa Fe Depot.

E. MINIMIZE IMPACTS TO NATURAL RESOURCES

Wetland Resources

Alignment Evaluation/Comparison:

Options D1a/b: Wetland and riparian areas known to occur within or adjacent to this alignment include Loma Alta Creek, Buena Vista Lagoon, Agua Hedionda Lagoon, Batiquitos Lagoon, San Elijo Lagoon, San Dieguito River, Soledad Creek Inlet, Los Penasquitos Canyon Creek, Rose Creek, Mission Bay, Tecolote Creek, and the San Diego River floodway.

Option D2: Wetland and riparian areas known to occur within or adjacent to this alignment include Loma Alta Creek, Buena Vista Lagoon, Agua Hedionda Lagoon, Batiquitos Lagoon, San Elijo Lagoon, San Dieguito River, Soledad Creek Inlet, Los Penasquitos Canyon Creek, Rose Creek, Mission Bay, Tecolote Creek, and the San Diego River floodway.

Station Evaluation/Comparison: There are no known wetland or riparian areas that would be impacted by the Santa Fe Depot, or the proposed stations at UTC or the San Diego Airport. There are wetland or riparian areas that could potentially be impacted by the Oceanside and Solana Beach stations, at both the existing LOSSAN station and the proposed I-5 station.

Water Resources

Alignment Evaluation/Comparison:

Options D1a/b: There are approximately 13 surface water resources crossed by this alignment option. These include the San Dieguito River, the creeks of Loma Alta, Los Penasquitos Canyon, Rose, Tecolote, and several other small, unnamed creeks, Buena Vista, Agua Hedionda, Batiquitos, and San Elijo lagoons, the inlet to Soledad Creek, Mission Bay, and the San Diego River floodway.

Option D2: There are approximately 17 surface water resources crossed by this alignment option. These include the San Dieguito River, the creeks of San Mateo, San Onofre, Horno Canyon, Las Pulgas Canyon, Loma Alta, Los Penasquitos Canyon, Rose, Tecolote, and several other small, unnamed creeks, the San Diego River floodway, Mission Bay, Soledad Creek inlet, and Buena Vista, Agua Hedionda, Batiquitos, and San Elijo lagoons.

Station Evaluation/Comparison: There are no known impacts to any water resources due to the proposed station options for this segment.

Floodplain Impacts

Alignment Evaluation/Comparison:

Options D1a/b: From the northern boundary of Oceanside to the I-5/I-8 interchange, approximately nine 100-year floodplain zones are crossed. The 100-year floodplain zones are associated with the San Dieguito River, the creeks of Los Penasquitos Canyon, Rose Canyon, Tecolote, the Soledad Creek Inlet, and the lagoons of Buena Vista, Agua Hedionda, Batiquitos, San Elijo, and several unnamed drainage areas.

Option D2: The 100-year floodplain zones that are crossed within this option are the same zones described previously for Option D1a/b.

Station Evaluation/Comparison: There are no known floodplain impacts at any of the proposed station options along this segment.

Threatened & Endangered Species Impacts

Alignment Evaluation/Comparison:

Options D1a/b: The following 36 threatened and endangered species or species of special concern are known to occur within this alignment option:

- Coast Wooly Head's (Species of Special Concern)
- Tidewater Goby (Endangered: Federal listing)
- Nuttall's Lotus (Species of Special Concern)
- Cliff Spurge (Species of Special Concern)
- Spreading Navarretia (Threatened: Federal listing)
- Riverside Fairy Shrimp (Endangered: Federal listing)
- Orange-Throated Whiptail (Species of Special Concern)
- Belding's Savannah Sparrow (Endangered: State listing)
- Coastal California Gnatcatcher (Threatened: Federal listing)
- Coulter's Goldfield's (Species of Special Concern)
- Decumbent Goldenbush (Species of Special Concern)
- Del Mar Mesa Sand Aster (Species of Special Concern)
- Wart-Stemmed Ceanothus (Species of Special Concern)
- Tiger Beetle (Species of Special Concern)
- Monarch Butterfly (Species of Special Concern)
- Light-Footed Clapper Rail (Endangered: Federal and State listing)
- Orcutt's Spineflower (Endangered: Federal and State listing)
- Sea Dahlia (Species of Special Concern)
- Woven-Spored Lichen (Species of Special Concern)
- Summer Holly (Species of Special Concern)
- Short-Leaved Dudleya (Endangered: State listing)
- San Diego Barrel Cactus (Species of Special Concern)
- Del Mar Manzanita (Endangered: Federal listing)
- Southern Coastal Salt Marsh (Species of Special Concern)
- Torrey Pine Forest (Species of Special Concern)
- Coastal Dunes Milk-Vetch (Endangered: Federal and State listing)

- Southern Maritime Chaparral (Species of Special Concern)
- Lakeside Ceanothus (Species of Special Concern)
- California Black Rail (Threatened: State listing)
- Southern California Rofous-Crowned Sparrow (Species of Special Concern)
- Southern Riparian Forest (Species of Special Concern)
- Nuttall's Scrub Oak (Species of Special Concern)
- Brand's Phacelia (Species of Special Concern)
- Variegrated Dudleya (Species of Special Concern)
- Southern Cottonwood Willow Riparian Forest (Species of Special Concern)
- Western Snowy Plover (Threatened: Federal, Endangered: State listing)

The bypass tunnels at Del Mar (Option D1b) and University City may avoid the habitat of some of these species.

Option D2: The threatened and endangered species or species of special concern known to occur within the alignment option are the same as described previously for Options D1a/b.

Station Evaluation/Comparison: The Woven-Spored Lichen and the San Diego Barrel Cactus are known to occur with the vicinity of the UTC station. There are no known threatened or endangered species or species of special concern that occur in the vicinity of the Solana Beach, San Diego Airport stations, or the Santa Fe Depot.

F. MINIMIZE IMPACTS TO SOCIAL AND ECONOMIC RESOURCES

Environmental Justice Impacts (Demographics)

Alignment Evaluation/Comparison:

Options D1a/b: Minority populations that are potentially affected by this option were identified in several 1990 Census block groups in the cities of Oceanside, Carlsbad, Solana Beach, and San Diego. The minority population potentially affected within these block groups was estimated to be approximately 5,250 people. Low-income households were identified in several block groups in the City of San Diego. Within these block groups, the alignment option could potentially impact an estimated 45 low-income households.

Option D2: Minority populations that are potentially affected by this option were identified in several 1990 Census block groups in the cities of Oceanside, Carlsbad, Solana Beach, and San Diego. The minority population potentially affected within these block groups was estimated to be approximately 8,950 people. Low-income households were identified in several block groups in the City of San Diego. Within these block groups, the alignment option could potentially impact an estimated 45 low-income households.

Station Evaluation/Comparison:

Options D1a/b: There is a potential impact to approximately 500 people to the proposed station at the San Diego Airport. There are no known impacts to minority populations at or in proximity to the Solana Beach stations, UTC, or the Santa Fe Depot. There are no known low-income households that occur at or in proximity to the proposed or existing stations that occur within this alignment option.

Option D2: There are no known impacts to minority populations at or in proximity to the Solana Beach station within this option. There are no known low-income households that

occur at or in proximity to the proposed stations or existing stations that occur within this option.

Community and Neighborhood Impacts

Alignment Evaluation/Comparison:

Options D1a/b: This segment follows the existing SDNR rail corridor through the cities of Oceanside, Carlsbad, Encinitas, Solana Beach, Del Mar and San Diego. The proposed alignment follows the coast until it enters the City of San Diego and then the direction of the alignment turns inland.

As the segment enters Oceanside it is parallel to Cleveland Street and Broadway through the community of South Oceanside. The alignment continues south along the SDNR rail corridor through the cities of Carlsbad and the community of Leucadia in Encinitas. The rail corridor runs parallel to Coast Highway 101 (S-21) and the coast through Encinitas and the community of Cardiff By-The-Sea (Encinitas). It also crosses over the San Elijo Lagoon and San Elijo Lagoon County Park and Ecological Reserve. The alignment continues through Solana Beach and the community of Eden Gardens (Solana Beach) parallel to S-21. The alignment then continues south through Del Mar adjacent to the Del Mar Fairgrounds.

As the alignment crosses the San Dieguito River it is located within 200 feet (61.0 meters) of the coastline. The alignment enters the community of Torrey Pines in the City of San Diego at the north end of Torrey Pines State Reserve then heads east through the State Reserve toward Sorrento Valley Road and I-5. The LOSSAN corridor parallels I-5 through the community of Sorrento Hills (San Diego) to the east and the community of Sorrento Valley (San Diego) to the west. Option D1a follows a tunnel under Genesee Avenue, and Option D1b follows a tunnel under I-5. The alignment passes through the community of University City, then again turns south and parallels I-5 just west of the Rose Canyon. As the alignment crosses under SR-52, it passes immediately west of the Marian Bear Memorial Natural Park. Continuing south, the alignment traverses through the communities of Clairemont and Bay Park (San Diego). Mission Bay and the Mission Bay Park community (San Diego) are located adjacent to the rail corridor to the west. The proposed alignment crosses the San Diego River and continues south past the community of Old Town to the east. The alignment then crosses under I-5 again and continues parallel to I-5 past the community of Uptown to the east, and the community of Loma Portal, the U.S. Marine Corps Recruit Depot (closed) and the San Diego Airport to the west.

This option would not cause any new physical barriers or divisions within the communities or neighborhoods listed because the alignment would follow an existing railroad corridor. However, Option D1a includes widening of the right-of-way in beach communities and would reduce beach access by automobile due to increased trains at grade crossings. Option D1b would form a physical barrier parallel to the beach, but would be less disruptive to automobile traffic because of full grade separation of the LOSSAN alignment.

Option D2: The alignment passes through the cities of Oceanside, Carlsbad, Encinitas, Solana Beach, and San Diego. The alignment leaves Oceanside and continues south, adjacent to Recreation Park and Center City Golf Course. The proposed alignment continues through the community of South Oceanside, located west of the corridor.

The proposed alignment traverses through Carlsbad past a Private School and Holiday Park on the east and two Public Schools and Brierly and Chase Fields on the west. I-5 enters the community of Leucadia in Encinitas and continues past the community of Cardiff By-The-Sea

(Encinitas) on the west. The alignment continues through Encinitas into Solana Beach and the community of Eden Gardens (Solana Beach) on the west. Two high schools are located west of I-5. The alignment then continues south, enters the City of San Diego past Surf and Turf Recreation Park to the west, traverses over the San Dieguito River and through Crest Canyon Open Space Park into the community of Torrey Pines.

The proposed alignment then continues south adjacent to the Torrey Pines State Reserve and the communities of Sorrento Valley to the west and Sorrento Hills to the east. I-5 travels through the University of California, San Diego (UCSD) and adjacent to the community of La Jolla on the west and the community of University City on the east. The alignment passes through the community of Clairemont and on into the community of Bay Park. The Mission Bay Park community is located adjacent to I-5 to the west.

The proposed alignment then crosses the San Diego River and continues south past the community of Old Town to the east. The corridor continues parallel to the SDNR rail corridor, with the community of Uptown to the east and the community of Loma Portal, the U.S. Marine Corps Recruit Depot (closed) and the San Diego Airport on the west. The stations within this option are located within the cities of Oceanside, Solana Beach, and San Diego.

This option would not cause any new physical barriers or divisions within the communities or neighborhoods listed because the alignment would follow an existing freeway corridor.

Station Evaluation/Comparison:

Option D2; Solana Beach: The city of Solana Beach and the community of Eden Gardens would be impacted by the proposed station.

Option D1a; University Towne Centre: The San Diego community of University City would be the only community to be impacted by the proposed station.

Option D2; San Diego Airport: The City of San Diego, Old Town, and Loma Portal would be the only communities and neighborhoods to be impacted by the proposed station.

The station in Solana Beach along the LOSSAN corridor and the Santa Fe Depot are both existing stations. Proposed expansion of these stations has the potential to create additional parking and traffic in the station areas.

Farmland Impacts

Alignment Evaluation/Comparison:

Options D1a/b: Farmland of local importance is located between I-5 and the LOSSAN corridor, south of Palomar Airport Road and north of Poinsettia Lane in Carlsbad. Prime farmland is located to the west of the LOSSAN corridor just south of Poinsettia Lane. Unique farmland is located east of the LOSSAN corridor north and south of Poinsettia Lane. Farmland of local importance is located south of Ponto Road and north of La Costa Avenue east and west of the LOSSAN corridor. Parcels of prime farmland are located adjacent to and east of the LOSSAN corridor south of La Costa Avenue.

Option D2: A parcel of unique farmland is located east of I-5, just south of Marron Road in Oceanside. Prime farmland is located east of I-5 in the vicinity of Cannon Road in Carlsbad. Farmland of local importance is located between I-5 and the LOSSAN corridor, south of Palomar Airport Road and north of Poinsettia Lane, and east and west of I-5 south of Ponto

Road and north of La Costa Avenue. A parcel of prime farmland is located west of I-5 just south of La Costa Avenue. Farmland of statewide importance is located west of I-5, south of Santa Fe Drive in Encinitas. A parcel of prime farmland is located east of I-5 in proximity to Manchester Avenue. A parcel of unique farmland is located east of I-5 at Governor Drive in the City of San Diego.

Station Evaluation/Comparison: There are no impacts to prime or unique farmland or farmland of statewide importance associated with any of the proposed station sites in this segment.

G. MINIMIZE IMPACTS TO CULTURAL RESOURCES

Cultural Resources Impacts

Alignment Evaluation/Comparison:

Options D1a/b: The Carlsbad Village Depot is a listed National Register historic landmark. Also, several properties along the alignment option within Old Town San Diego are also listed on the National Register.

Option D2: The cultural and historic resources known to occur along this option are similar to those for Options D1a/b.

Station Evaluation/Comparison: There are no known cultural resources that occur in the immediate vicinity of the proposed station sites in Solana Beach, UTC, and the San Diego Airport. There are several cultural resources that occur in the immediate vicinity of the Santa Fe Depot in downtown San Diego. The Santa Fe Depot itself is considered an historic landmark.

Parks & Recreation/Wildlife Refuge Impacts

Alignment Evaluation/Comparison:

Options D1a/b: The following 14 parks and recreation/wildlife refuge resources are known to occur within this segment.

- Rotary Park
- Magee Park
- Leucadia Roadside Park
- Sea Cliff Park
- San Elijo State Park
- San Elijo Lagoon County Park & Ecological Reserve
- Torrey Pines State Beach
- Torrey Pines State Reserve
- Rose Canyon Open Space
- Marian Bear Memorial Natural Park
- Mission Bay Park
- Old Town San Diego Historic Park

(The parks below are bypassed by the tunnel under Del Mar in Option D1b.)

- Powerhouse Park
- Seagrove Park

Option D2: The following 15 parks and recreation/wildlife refuge resources are known to occur within this segment.

- Recreation Park
- Center City Golf Course
- Holiday Park
- James Macpherson Park
- Paul Ecke Sports Park
- San Elijo Lagoon County Park and Ecological Reserve
- Surf and Turf Recreation Park
- Crest Canyon Open Space Park
- Overlook Park (Open Space)
- Torrey Pines State Reserve
- Marian Bear Memorial Natural Park
- Soledad Natural Park
- Mission Bay Park
- Old Town San Diego Historic Park

Station Evaluation/Comparison: Rotary Park and Magee Park are in the vicinity of the Oceanside stations. There are no parks and recreation/wildlife refuge resources that occur in the immediate vicinity of the Santa Fe Depot or the proposed Solana Beach, UTC, or San Diego Airport stations.

H. MAXIMIZE AVOIDANCE OF AREAS WITH GEOLOGIC AND SOILS CONSTRAINTS

Soils/Slope Constraints

Alignment Evaluation/Comparison:

Options D1a/b: There are seven distinct soil types within this alignment option. Throughout the coastal portions of San Diego County, the proposed alignment traverses areas subject to liquefaction and earthquake induced slides. The area most subject to liquefaction associated with unstable soil conditions occur along the bluffs in the cities of Encinitas, Del Mar and Solana Beach.

Option D2: Soil types within this option are the same as described in Option D1a-b. The potential for liquefaction and earthquake induced slides within this alignment option and station siting are the same as described in Option D1a-b.

Station Evaluation/Comparison: There is one distinct soil type identified for the stations located in Oceanside, Solana Beach, and at the UTC. One soil type is also identified for the Santa Fe Depot and the proposed station at San Diego Airport. Possible impacts from liquefaction occur in the immediate vicinity of all the proposed stations.

Seismic Constraints

Alignment & Station Evaluation/Comparison: The Rose Canyon fault is an active seismic area and fault known to occur within the vicinity of all the alignment and station options in this segment. There are no alignments or stations that cross or are located on the fault.

Alignment Option D1a passes through part of Rose Canyon and would have the greatest potential for seismic constraints.

I. MAXIMIZE AVOIDANCE OF AREAS WITH POTENTIAL HAZARDOUS MATERIALS

Hazardous Materials/Waste Constraints

Alignment Evaluation/Comparison:

Options D1a/b: There are several known hazardous waste sites that are located adjacent to the LOSSAN corridor within this segment. The known sites include two in Carlsbad and one in Encinitas. Several are located along the corridor in the City of San Diego with the greatest concentrations occurring near the San Diego Airport (Option D2).

Option D2: There are several known hazardous waste sites that are located adjacent to I-5 within this segment. One is located in Carlsbad near Palomar Airport Road. Several known sites are located along the corridor in the City of San Diego with the greatest concentrations occurring near the San Diego Airport.

Station Evaluation/Comparison: There are no known hazardous material/waste sites in the immediate vicinity of the proposed station sites for Solana Beach, UTC, or the Santa Fe Depot. There are two known hazardous material/waste sites in the immediate vicinity of the proposed station at the San Diego Airport.

4.2 LOSSAN CORRIDOR ELECTRIFICATION OPTIONS

Throughout this report, options for incrementally upgrading the LOSSAN corridor have been discussed in the context of two distinct configurations, the "a" configurations (Options B1a, C1a and D1a) and the "b" configurations (Options B1b, C1b and D1b). This approach was taken to simplify the presentation of evaluation data.

However, the LOSSAN "a" and "b" configurations should be seen as two bookends in what is in fact a continuous spectrum of design options. By drawing selectively from different elements of "a" and "b" in different parts of the corridor, it is possible to configure a large number of distinct configurations between the two extremes discussed in this report.

This view applies particularly to the issue of electrification. All of the "a" options assume that conventional diesel or natural gas (fossil fuel) locomotives would continue to be used in the LOSSAN corridor. The "b" configurations assume that the corridor would be fully electrified using an overhead catenary system, allowing both electric and fossil-fuel locomotives to serve the corridor.

However, all of the other physical improvements of the "b" configurations are independent of whether or not the corridor is electrified. Their merits, costs and impacts can be assessed separately from those of electrification. In effect, one can think of the "b" configurations as embodying two design options, one with electrification, and the other without.

To facilitate this view, this section draws out some key differences between the configurations with or without electrification, and summarizes the features that distinguish them in terms of costs, ridership implications and environmental impacts. This comparative evaluation draws on the full analysis conducted for each option, as described in the preceding sections. To facilitate the comparison of design options, only the criteria that reveal significant differences between the options are discussed.

Maximize Ridership/Revenue Potential

Travel time, and hence ridership, would be moderately improved, due to the superior acceleration characteristics of electric locomotives relative to fossil-fuel units, and their ability to reach a higher top-speed (although this would only occur through Camp Pendleton). A specific analysis of the travel time effects of electrifying the corridor was not conducted, however, a rough estimate of its potential contribution can be derived by comparing the average speed of the "a" and "b" configurations. From LA Union Station to San Diego, the fossil fuel "a" configurations averaged 96 mph (153.6 km/h), while the electric "b" configurations averaged 103 mph (164.8 km/h). Note that since other traffic on the line was not modeled, these represent best-case unconstrained semi-express travel-times. On the approximately 122-mile (197 km) trip between Los Angeles and San Diego, the "b" configurations achieved a trip time of about 70 minutes, some 5 minutes faster than the "a" configurations. Some of the difference is due to variations in alignment and profile, and some to electrification. However, in this corridor, it appears the performance benefits of electrification are moderate.

Maximize Connectivity and Accessibility

Rather than travel time, the biggest effect on ridership would be from the ability to through-run trains to the rest of the statewide system, assuming current regulatory barriers to mixing high-speed and conventional trains are overcome. Eliminating the need for a transfer would have a significant effect on ridership.

Minimize Operating and Capital Costs

Fully electrifying the LOSSAN corridor would cost approximately $390 million, which is less than 10 percent of the preliminary cost estimate for the "b" configurations from Los Angeles to San Diego. This cost accounts for all the equipment needed to electrify and power the corridor, however, does not include the cost of retrofitting or replacing older bridges that do not meet current clearance standards (for overhead power distribution systems).

The lack of a need for transfers simplifies operations and scheduling and potentially makes more cost-effective use of the vehicle fleet, as there is no need to design "train-meet" schedules.

Although not a direct impact of the high-speed train system, a concern about electrification is that it would put pressure on the other users of the corridor – Amtrak, Metrolink, Coaster and BNSF freight – to also electrify, leading to cost impacts to these agencies.

Maximize Compatibility with Existing and Planned Development

Communities along the LOSSAN corridor share a concern about the potential visual impact of the overhead catenary system. Although most prevalent in the coastal communities where the catenary may interfere with ocean views, this concern is present in all residential areas. As the "b" configurations generally embody profile changes (trenches, tunnels) or deviations off the LOSSAN corridor in sensitive areas, this impact may be mitigated. Nevertheless, it remains a significant concern.

Countering the potential visual impact would be improvements in noise and air quality impacts, due to the quieter, cleaner electric locomotives.

Communities also perceive that electrification of the corridor amounts to adding a new layer of train service; one that is capable of significantly higher speeds and shorter headways than conventional services. The frequency of service in this corridor is independent of its traction power, and speeds in urban areas would be governed by other factors such as track geometry and the presence of stations and grade crossings. Nevertheless, this perception remains a concern.

Summary

As described above, the inclusion of electrification in the LOSSAN "b" configurations brings with it benefits and impacts in the following areas:

- Improved travel time
- No need to transfer between rail systems
- Higher capital costs
- Simplified operations
- Pressure on other services in the LOSSAN corridor
- Visual impacts due to catenary
- Noise and air quality improvements
- Perception of more frequent/faster train movements

All other benefits and impacts of the "b" configurations described in the preceding sections are the same, whether electrification is included or not.

Table 4.1-1
Los Angeles to San Diego via Orange County - High-Speed Train Alignment Evaluation Matrix
Segment A - LA Union Station/Southeast LA County to LAX[27]

Evaluation Criteria	Alignment Option A1	Alignment Option A2	Alignment Option A3	Alignment Option A5
Maximize Ridership/Revenue Potential.				
Travel Time *(Exp.=Express)*	(Exp.) LA Union Station to: LAX – 18.2 min	(Exp.) LA Union Station to: LAX – 14.4 min	(Exp.) LA Union Station to: LAX – 17.0 min	(Local) Southeast LA to: LAX – 35.3 min
	3	4	3	2
Length	23.2 miles (37.3 km)	15.8 miles (25.4 km)	20.6 miles (33.2 km)	21.1 miles (33.8 km) total *15.9 miles (25.4 km) existing*
	2	4	3	3
Population & Employment Catchment	See LAX and LA Union Station in Table 4.1-5	See LAX and LA Union Station in Table 4.1-5	See LAX and LA Union Station in Table 4.1-5	Numerous stations in I-105 corridor, including LAX and Norwalk in Tables 4.1-5 and 4.1-6
	4	4	4	3
Maximize Connectivity and Accessibility.				
Intermodal Connections	See LAX and LA Union Station in Table 4.1-5	See LAX and LA Union Station in Table 4.1-5	See LAX and LA Union Station in Table 4.1-5	Numerous stations in I-105 corridor, including LAX in Table 4.1-5 and Norwalk in Table 4.1-6
	4	4	4	3
Minimize Operating and Capital Costs.				
Length	23.2 miles (37.3 km)	15.8 miles (25.4 km)	20.6 miles (33.2 km)	5.2 miles (8.4 km) new *15.9 miles (25.4 km) existing*
	3	4	3	5

1 2 3 4 5
Highly Unfavorable Highly Favorable

[27] Alignment Option A4 is not listed in this alignment evaluation matrix

Evaluation Criteria	Alignment Option A1	Alignment Option A2	Alignment Option A3	Alignment Option A5
Operational Issues	There are several curves along this alignment that restrict speed to 50 mph (80 km/h) and lengthen the overall trip times. This alignment has the longest distance and longest simulated trip times of this segment. Dedicated alignment along I-10 and I-405.	Dedicated alignment on MTA Harbor Subdivision, an existing rail line. This alignment has the shortest distance and shortest trip times of this segment. There are no curves tight enough to restrict speeds to 50 mph (80 km/h). However, there are curves that restrict speed to 75 mph (120 km/h).	This alignment is similar to Option A1, but is a shorter length and therefore shorter travel time. Dedicated alignment on I-110 and I-105.	Extension of existing LRT service, with numerous intermediate stops and the longest travel time.
	2	3	2	3
Construction Issues	General freeway alignment issues include room for columns, high aerial structures to pass over arterial highways and freeways, and staging of construction. Third/fourth level aerial construction along I-10 and I-405, due to elevated freeway segments and complex freeway/arterial interchanges. Potential physical conflict within LAX Expressway (elevated bypass), being studied for the median of I-405, from SR-90 to Century Boulevard Potential conflict with proposed maglev system along nearly 100% of the same alignment from LA Union Station to LAX.	Dedicated alignment may not be possible on west side of LA River, given existing/proposed Amtrak and Metrolink route to LA Union Station System is aerial to cross Alameda Corridor (freight) and MTA Blue Line in east, I-405 in west. Due to numerous crossing streets, trench assumed alongside Slauson and Florence Avenues, with two crossings closed.	General issues related to construction in a freeway alignment. Third/fourth level aerial construction along I-10, I-110 and I-105, due to elevated freeway segments and existing arterial overcrossings I-110 has an aerial viaduct with HOV lanes in the median, I-105 has MTA Green Line in the median.	Extension northwest to LAX is projected in future but subject to master planning for LAX. For connection to Norwalk, extension east from I-605 would be aerial along existing arterial highway; not part of future MTA plans Alignment in median of I-105 already served by LRT and would require minimal new construction.
	1	2	1	3
Capital Cost	Very High Cost	High Cost	Very High Cost	Least Cost
	1	2	1	5

1 2 3 4 5
Highly Unfavorable Highly Favorable

Evaluation Criteria	Alignment Option A1	Alignment Option A2	Alignment Option A3	Alignment Option A5
Right-of-Way Issues/Cost	Very limited right-of-way available adjacent to freeways, median is also constrained	MTA owns the right-of-way, and may convert it for light rail or shared-use commuter rail and freight. Also, right-of-way is single track and parts may be too narrow.	Very limited right-of-way available adjacent to freeways, median also constrained	Extension would be aerial and follow arterial highway medians. Constrained portion (along I-105 median) already built.
	1	2	1	3
Maximize Compatibility with Existing and Planned Development.				
Land Use Compatibility and Conflicts	Low- to medium-density residential with mixture of commercial and industrial uses. Parks, schools, and jail located adjacent to corridor.	Land uses similar to Option A1.	Low- to medium-density residential and commercial. Parks, schools, colleges and Hawthorne municipal airport is located adjacent to corridor.	Land uses similar to Option A3. Low-density residential and hospital located along alignment in Norwalk.
	3	3	3	4
Visual Quality Impacts	High aerial structure added to existing freeway alignments. Visual impacts to and from heavy urbanized areas of suburban and downtown Los Angeles. Few areas of open space and natural vegetation along corridor.	Impacts along half of this alignment are mitigated by a trench, otherwise visual impacts are the same as described in Option A1.	Visual impacts are the same type described in Option A1.	Visual impacts are the same type described in Option A1, but the length of the new alignment is very short.
	3	4	3	4
Minimize Impacts to Natural Resources.				
Wetland Impacts	Wetland areas known to occur within this option are the LA River, Ballona Creek, and Centinela Creeks.	1 Wetland area is known to occur within this option; the LA River.	Wetland areas known to occur within this option are the LA River and Dominguez Creeks.	Wetland areas known to occur within this option are the LA and San Gabriel Rivers and the Dominguez and Compton Creeks.
	3	3	3	3
Water Resources	There are 3 water resource crossings.	There is 1 water resource crossing.	There are 2 water resource crossings.	There are 4 water resource crossings.
	3	3	3	3

1 2 3 4 5
Highly Unfavorable — Highly Favorable

Evaluation Criteria	Alignment Option A1	Alignment Option A2	Alignment Option A3	Alignment Option A5
Floodplain Impacts	No floodplain impacts.	Floodplain adjacent to rail line within the City of Los Angeles.	No floodplain impacts.	No floodplain impacts.
	3	2	3	3
Threatened & Endangered Species Impacts	There is 1 endangered, 1 threatened, and 1 species of special concern located within this option.	There is 1 endangered and 2 species of special concern located within this option.	There is 1 endangered species located within this option.	There is 1 endangered species located within this option.
	2	2	2	2
Minimize Impacts to Social and Economic Resources.				
Environmental Justice Impacts (Demographics)	Potential impacts to minority population of approximately 105,000 people within this alignment option. Also potential impacts to approximately 540 low-income households within this alignment option.	Potential impacts to minority population of approximately 43,000 people within this alignment option. Also potential impacts to approximately 609 low-income households within this alignment option.	Potential impacts to minority population of approximately 154,000 people within this alignment option. Also potential impacts to approximately 900 low-income households within this alignment option.	Potential impacts to minority population of approximately 128,000 people within this alignment option. Also potential impacts to approximately 986 low-income households within this alignment option.
	1	2	1	2
Community and Neighborhood Impacts	There are impacts to 7 communities and neighborhoods within this alignment option.	There are impacts to 7 communities and neighborhoods within this alignment option.	There are impacts to 6 communities and neighborhoods within this alignment option.	There are impacts to 13 communities and neighborhoods within this alignment option.
	2	3	2	3
Farmland Impacts	No farmland impacts.	No farmland impacts.	No farmland impacts.	No farmland impacts.
	5	5	5	5
Minimize Impacts to Cultural Resources.				
Cultural Resources Impacts	4 sites of cultural or historic significance occur adjacent to this alignment option.	Several known sites of cultural or historic significance occur adjacent to this alignment option.	Several known sites of cultural or historic significance occur adjacent to this alignment option.	No known cultural or historic sites.
	3	2	2	4
Parks & Recreation/Wildlife Refuge Impacts	There are 8 Parks and Recreation/Wildlife Refuge resources.	There are 3 Parks and Recreation/Wildlife Refuge resources.	There are 3 Parks and Recreation/Wildlife Refuge resources.	There are 2 Parks and Recreation/Wildlife Refuge resources.
	2	3	3	3

Evaluation Criteria	Alignment Option A1	Alignment Option A2	Alignment Option A3	Alignment Option A5
Maximize Avoidance of Areas with Geologic and Soils Constraints.				
Soils/Slope Constraints	There are 3 distinct soil types. Possible impacts from liquefaction and landslide occur along I-10 and I-405 near I-10 intersection. Potential earthquake induced landslides near LA Union Station.	Soils types are the same as described in Option A1. Potential hazard of liquefaction in area east of I-110. Some localized areas of potential earthquake induced landslides are the same as described in alignment Option A1.	Soils types are the same as described in Option A1. Potential for liquefaction along I-110 corridor south of Vernon Street. No potential impacts from liquefaction occur along I-105 corridor.	Soils types are the same as described in Option A1. Potential hazard of liquefaction in area east of I-110.
	3	3	3	3
Seismic Constraints	Potential impacts from 3 major seismic areas and faults occur within this alignment option. No faults are crossed by this alignment.	Seismic areas and faults along this alignment option are the same as Option A1.	Seismic areas and faults along this alignment option are the same as Option A1.	Seismic areas and faults along this alignment option are the same as Option A1.
	3	3	3	3
Maximize Avoidance of Areas with Potential Hazardous Materials.				
Hazardous Materials/Waste Constraints	Several known hazardous waste sites occur along I-405 and I-10. A large concentration of sites is in close proximity to LA Union Station and the LOSSAN corridor.	Numerous hazardous waste sites located adjacent to alignment. Greatest concentration of sites located in the vicinity of the Alameda Corridor.	Several hazardous waste sites occur along I-105 corridor. No known sites along I-110 corridor. Numerous sites located along I-10 corridor with greatest concentration in proximity to LA Union Station.	Several hazardous waste sites located along MTA Green Line in proximity to Imperial Avenue and along the LOSSAN corridor.
	2	2	2	2

1 2 3 4 5
Highly Unfavorable Highly Favorable

Table 4.1-2
Los Angeles to San Diego via Orange County - High-Speed Train Alignment Evaluation Matrix
Segment B - LA Union Station to Central Orange County (Anaheim)

Evaluation Criteria	Alignment Option B1a	Alignment Option B1b	Alignment Option B2	Alignment Option B3	Alignment Option B4
Maximize Ridership/Revenue Potential.					
Travel Time *(Exp.=Express)*	(Local) LA Union Station to: Norwalk – 11.7 min Fullerton – 19.4 min Anaheim – 25.4 (Exp.) LA Union Station to: Anaheim – 19.4 min	(Local) LA Union Station to: Norwalk – 11.1 min Anaheim – 21.7 min (Exp.) LA Union Station to: Anaheim – 18.3 min	(Local) LA Union Station to: Norwalk – 11.8 min Anaheim – 22.1 min (Exp.) LA Union Station to: Anaheim – 19.0 min	(Local) LA Union Station to: Paramount – 9.6 min Garden Grove – 19.2 min (Exp.) LA Union Station to: Garden Grove – 16.4 min	(Local) LA Union Station to: Norwalk – 11.4 min Anaheim – 20.9 min (Exp.) LA Union Station to: Anaheim – 17.1 min
	2	3	3	4	4
Length	30.0 miles (48.3 km)	30.0 miles (48.3 km)	28.3 miles (45.5 km)	28.69 miles (46.18 km)	28.67 miles (46.15 km)
	3	3	3	3	3
Population & Employment Catchment	See LA Union Station in Table 4.1-5, Norwalk in Table 4.1-6, and Anaheim in Table 4.1-7	See LA Union Station in Table 4.1-5, Norwalk in Table 4.1-6, and Anaheim in Table 4.1-7	See LA Union Station in Table 4.1-5, Norwalk in Table 4.1-6, and Anaheim in Table 4.1-7	See LA Union Station in Table 4.1-5, Paramount in Table 4.1-6, and Garden Grove in Table 4.1-7	See LA Union Station in Table 4.1-5, Norwalk in Table 4.1-6, and Anaheim in Table 4.1-7
	4	3	3	4	3
Maximize Connectivity and Accessibility.					
Intermodal Connections	See LA Union Station in Table 4.1-5, Norwalk in Table 4.1-6, and Anaheim in Table 4.1-7	See LA Union Station in Table 4.1-5, Norwalk in Table 4.1-6, and Anaheim in Table 4.1-7	See LA Union Station in Table 4.1-5, Norwalk in Table 4.1-6, and Anaheim in Table 4.1-7	See LA Union Station in Table 4.1-5, Paramount in Table 4.1-6, and Garden Grove in Table 4.1-7	See LA Union Station in Table 4.1-5, Norwalk in Table 4.1-6, and Anaheim in Table 4.1-7
	4	4	3	3	3
Minimize Operating and Capital Costs.					
Length	30.0 miles (48.3 km)	30.0 miles (48.3 km)	28.3 miles (45.5 km)	28.69 miles (46.18 km)	28.67 miles (46.15 km)
	3	3	3	3	3

1 2 3 4 5
Highly Unfavorable Highly Favorable

Evaluation Criteria	Alignment Option B1a	Alignment Option B1b	Alignment Option B2	Alignment Option B3	Alignment Option B4
Operational Issues	Shared-use alignment, with delays from other rail traffic. This alignment has longest distance of this segment. The curves are moderate and simulated trip times are in the mid-range. There are several curves restraining speed to 75 mph (120 km/h).	There are no differences in trip time simulations between the 3-track Option B1a and the 4-track Option B1b. The complete fourth main track allows some segregation of passenger and freight, which adds operational flexibility and trip time reliability, compared with Option B1a.	Follows a freeway and has the most restrictive speed constraints and the largest simulated trip times for this segment. There are three curves limiting speed to 50 mph (80 km/h), and many other curves limiting speed to 75 mph (120 km/h). Dedicated VHS alignment.	This distance of this alignment is in the middle range for this segment. It has only one curve that restricts speed to 50 mph (80 km/h), and the simulated trip times are the shortest of this segment. Dedicated VHS alignment	This distance of this alignment is in the middle range for this segment. It has few speed constraints and short simulated trip times. There are several curves limiting the speed to 75 mph (120 km/h). Dedicated VHS alignment.
	2	3	2	4	4
Construction Issues	Some track construction from LA to Commerce and in Fullerton. Some additional grade-separations proposed – No major issues	Fourth Main track added in corridor along entire length from LA to Fullerton, numerous grade-separations of streets required in Anaheim - No major issues, but more complex than Option B1a.	General issues related to construction within a freeway alignment (See Option A1). Third level aerial construction along significant potion of I-5 due to existing arterial and railway over crossings Widening of I-5 has been studied in LA County (See right-of-way issues), and may complicate construction of VHS further. Follow UP right-of-way south of Beach Boulevard to Euclid, and thereafter, frontage road to Anaheim – avoids HOV structures in the median - this part of the alignment has fewer issues than LA County.	Grade-separated system in existing/former rail alignments, either aerial (industrial areas) or trench (residential areas) due to numerous existing street crossings Possible to cross LA River (South Gate), Rio Hondo and Coyote Creek at existing profile (two road closures needed), but tunnel under San Gabriel River required to retain trench profile in nearby residential areas. Two channel crossings in OC would require reconstruction due to the trench profile.	Grade-separated system on existing rail alignment, either aerial (industrial areas) or trench (residential areas) due to numerous existing grade crossings in LA County and Buena Park. Possible to cross LA River (South Gate), Rio Hondo and San Gabriel River at existing profile, with transitions to/from trench on approaches Existing profile from Beach to Euclid is grade-separated due to recent construction along I-5, at-grade construction appears feasible.
	5	3	1	1	2

1 2 3 4 5
Highly Unfavorable Highly Favorable

Evaluation Criteria	Alignment Option B1a	Alignment Option B1b	Alignment Option B2	Alignment Option B3	Alignment Option B4
Capital Cost	Least Cost	Moderate Cost	High Cost	Highest Cost	High Cost
	5	4	2	1	2
Right-of-Way Issues/Cost	Some right-of-way for additional tracks. Fewest issues for Segment B.	Some widening of rail right-of-way required – most adjacent property is industrial. More widening than Option B1a.	Limited Right of Way in freeway corridor. Some property available for columns between existing freeway and frontage roads, in LA County. UP owns and operates the Santa Ana Branch, used by freight traffic.	San Pedro Branch is an existing freight line, owned by BNSF PE right-of-way is owned by MTA and by OCTA, lightly used by freight and intended for future transit facility.	San Pedro Branch is an existing freight line, owned by BNSF UP owns and operates the Santa Ana Branch, used by freight traffic.
	4	3	1	3	2
Maximize Compatibility with Existing and Planned Development.					
Land Use Compatibility and Conflicts	Low- to medium-density residential with mixture of commercial and industrial uses and open space. Some parks and schools located along the alignment option.	Low- to medium-density residential with mixture of commercial and industrial uses and open space. Some parks and schools located along the alignment option.	Low- to medium-density residential with mixture of commercial and industrial uses. Some parks, schools, cemeteries, and a hospital located along the alignment option.	Land uses for this alignment option are the same as described in Alignment Option B1a, B1b, and B2.	Land uses for this alignment option are the same as described in Alignment Option B1a, B1b, and B2.
	3	3	2	2	2
Visual Quality Impacts	Widening of an existing rail alignment in industrial and some residential areas. Less heavy visual impacts as corridor transitions into Orange County. However visual impacts remain residential, commercial, and transportation/utility development.	Visual impacts are similar to Option B1a, but more widening would occur in the same area.	Land Uses are similar to Option B1a, but impacts would be greater as this option adds a high aerial structure to the freeway alignment.	Overall mix of land uses similar to Option B1a, but would add a new transportation facility to the alignment, mitigated by a proposed trench.	Visual impacts would be similar to Option B2.
	3	3	2	3	2

1 2 3 4 5
Highly Unfavorable — Highly Favorable

Evaluation Criteria	Alignment Option B1a	Alignment Option B1b	Alignment Option B2	Alignment Option B3	Alignment Option B4
Minimize Impacts to Natural Resources.					
Wetland Impacts	Wetland areas known to occur within this segment are the Los Angeles, Rio Hondo, San Gabriel, and Santa Ana Rivers, the North Fork Coyote, Coyote, Fullerton, Carbon Creeks, and Crescent Basin.	Wetland areas known to occur within this segment are the Los Angeles, Rio Hondo, San Gabriel, and Santa Ana Rivers, the North Fork Coyote, Coyote, Fullerton, Carbon Creeks, and Crescent Basin.	Wetland areas known to occur within this segment are the Los Angeles, Rio Hondo, San Gabriel, and Santa Ana Rivers, the North Fork Coyote, Coyote, Fullerton, Carbon Creeks, and Crescent Basin.	Wetland areas known to occur within this segment are the Los Angeles, Rio Hondo, and San Gabriel Rivers, and Coyote and Moody Creeks.	Wetland areas known to occur within this segment are the Los Angeles, Rio Hondo, San Gabriel, and Santa Ana Rivers, the North Fork Coyote, Coyote, Fullerton, Carbon Creeks, and Crescent Basin.
	3	3	3	3	3
Water Resources	Impacts to 9 water resources.	Impacts to 3 water resources.	Impacts to 3 water resources.	Impacts to 8 water resources.	Impacts to 8 water resources.
	3	3	3	3	3
Floodplain Impacts	Crosses 4 floodplains	Crosses 4 floodplains	Crosses 1 floodplains	Crosses 1 floodplains	No floodplain impacts.
	3	3	4	4	5
Threatened & Endangered Species Impacts	There is 1 specie of special concern located within this option.	There is 1 specie of special concern located within this option.	There are 2 species of special concern located within this option.	There are 3 endangered, 1 threatened, and 4 species of special concern located within this option.	There are 2 species of special concern located within this option.
	4	4	4	3	4
Minimize Impacts to Social and Economic Resources.					
Environmental Justice Impacts (Demographics)	Potential impacts to a minority population of approximately 40,000 people and potential impacts to approximately 395 low-income households.	Potential impacts to a minority population of approximately 40,000 people and potential impacts to approximately 395 low-income households.	Potential impacts to a minority population of approximately 78,000 people and potential impacts to approximately 709 low-income households.	Potential impacts to a minority population of approximately 89,000 people and potential impacts to approximately 415 low-income households.	Potential impacts to a minority population of approximately 62,000 people and potential impacts to approximately 415 low-income households.
	3	3	2	2	2
Community & Neighborhood Impacts	There are impacts to 12 communities and neighborhoods that occur within this alignment option.	There are impacts to 12 communities and neighborhoods that occur within this alignment option.	There are impacts to 11 communities and neighborhoods that occur within this alignment option.	There are impacts to 21 communities and neighborhoods that occur within this alignment option.	There are impacts to 10 communities and neighborhoods that occur within this alignment option.
	3	3	3	2	3

1 2 3 4 5
Highly Unfavorable — Highly Favorable

Evaluation Criteria	Alignment Option B1a	Alignment Option B1b	Alignment Option B2	Alignment Option B3	Alignment Option B4
Farmland Impacts	There is 1 parcel of prime farmland located within Orange County.	There is 1 parcel of prime farmland located within Orange County.	There are 2 parcels of prime farmland located within Orange County.	No farmland impacts.	No farmland impacts.
	4	4	4	5	5
Minimize Impacts to Cultural Resources.					
Cultural Resources Impacts	There are several sites of cultural or historic significance that occur adjacent to this alignment option.	There are several sites of cultural or historic significance that occur adjacent to this alignment option.	There are two sites of cultural or historic significance that occur adjacent to this alignment option.	No known sites of cultural or historic significance.	No known sites of cultural or historic significance.
	3	3	4	5	5
Parks & Recreation/Wildlife Refuge Impacts	There are 4 Parks and Recreation/Wildlife Refuge resources.	There are 4 Parks and Recreation/Wildlife Refuge resources.	There are 10 Parks and Recreation/Wildlife Refuge resources.	There are 9 Parks and Recreation/Wildlife Refuge resources.	There are 6 Parks and Recreation/Wildlife Refuge resources.
	4	4	3	3	3
Maximize Avoidance of Areas with Geologic and Soils Constraints.					
Soils/Slope Constraints	2 distinct soil types occur along this alignment option. Some localized areas of earthquake induced landslides.	Soil and Slope Constraints are similar to Option B1a.	Soil and Slope Constraints are similar to Option B1a.	Soil and Slope Constraints are similar to Option B1a.	Soil and Slope Constraints are similar to Option B1a.
	3	3	3	3	3
Seismic Constraints	Potential impacts from 2 major seismic areas and faults. No faults are crossed.	Seismic Constraints are similar to Option B1a.	Seismic Constraints are similar to Option B1a.	Seismic Constraints are similar to Option B1a. The Newport/Inglewood Fault is close to this alignment along the PE right-of-way.	Seismic Constraints are similar to Option B1a.
	3	3	3	2	3

1 2 3 4 5
Highly Unfavorable Highly Favorable

Evaluation Criteria	Alignment Option B1a	Alignment Option B1b	Alignment Option B2	Alignment Option B3	Alignment Option B4
Maximize Avoidance of Areas with Potential Hazardous Materials.					
Hazardous Materials/Waste Constraints	Several hazardous waste sites located adjacent to corridor. Greatest concentration of sites located in the cities of Fullerton and Santa Fe Springs.	Several hazardous waste sites located adjacent to corridor. Greatest concentration of sites located in the cities of Fullerton and Santa Fe Springs.	Several hazardous waste sites located adjacent to corridor. Greatest concentration of sites located in the cities of Norwalk and La Mirada.	Several hazardous waste sites located adjacent to corridor, but the fewest sites in total compared to the other alignment options within Segment B. The concentration of sites is located in the northern portion of the City of Downey.	Several hazardous waste sites located adjacent to corridor, but the fewest sites in total compared to the other alignment options within Segment B. The concentration of sites is located in the northern portion of the City of Downey.
	2	2	3	3	3

1 2 3 4 5
Highly Unfavorable Highly Favorable

Table 4.1-3
Los Angeles to San Diego via Orange County - High-Speed Train Alignment Evaluation Matrix
Segment C - Central Orange County (Anaheim) to Oceanside

Evaluation Criteria	Alignment Option C1a	Alignment Option C1b	Alignment Option C2	Alignment Option C3	Alignment Option C4
Maximize Ridership/Revenue Potential.					
Travel Time *(Exp.=Express)*	(Local) Anaheim to: Santa Ana – 6.6 min ITC – 14.7 min San Juan Cap. – 23.9 min OTC – 43.6 min (Exp.) Anaheim to: OTC – 33.9 min	(Local) Anaheim to: ITC – 11.2 min OTC – 38.5 min (Exp.) Anaheim to: OTC – 32.1 min	(Local) Anaheim to: Irvine – 9 min Oceanside – 35.9 min (Exp.) Anaheim to: Oceanside – 33.7 min	(Local) Garden Grove to: Newport Bch – 9.4 min Oceanside – 37.5 min (Exp.) Garden Grove to: Oceanside – 34.5 min	(Local) Anaheim to: Irvine – 8.9 min Oceanside – 39.8 min (Exp.) Anaheim to: Oceanside – 36.6 min
	3	3	4	4	3
Length	55.5 miles (89.3 km)	56.1 miles (90.3 km)	55.1 miles (88.6 km)	57.6 miles (92.7 km)	60.6 miles (97.5 km)
	3	3	3	3	2
Population & Employment Catchment	See Irvine in Table 4.1-8 and Oceanside in Table 4.1-9	See Irvine in Table 4.1-8 and Oceanside in Table 4.1-9	See Irvine in Table 4.1-8 and Oceanside in Table 4.1-9	See Newport Beach in Table 4.1-8 and Oceanside in Table 4.1-9	See Irvine in Table 4.1-8 and Oceanside in Table 4.1-9
	3	3	3	3	3
Maximize Connectivity and Accessibility.					
Intermodal Connections	See Irvine in Table 4.1-8 and Oceanside in Table 4.1-9	See Irvine in Table 4.1-8 and Oceanside in Table 4.1-9	See Irvine in Table 4.1-8 and Oceanside in Table 4.1-9	See Newport Beach in Table 4.1-8 and Oceanside in Table 4.1-9	See Irvine in Table 4.1-8 and Oceanside in Table 4.1-9
	4	4	3	2	3
Minimize Operating and Capital Costs.					
Length	55.5 miles (89.3 km)	56.1 miles (90.3 km)	55.1 miles (88.6 km)	57.6 miles (92.7 km)	60.6 miles (97.5 km)
	3	3	3	3	2

1 2 3 4 5
Highly Unfavorable Highly Favorable

Evaluation Criteria	Alignment Option C1a	Alignment Option C1b	Alignment Option C2	Alignment Option C3	Alignment Option C4
Operational Issues	Shared-use alignment, subject to delays from other rail traffic. The alignment is of medium length. It contains three curves with 50 mph (80 km/h) speed restrictions, and many 75 mph (120 km/h) speed restrictions.	Shared-use alignment, subject to delays from other rail traffic. The tunnels under Orange and Dana Point require 2% (approx.) transitions to/from grade, which slows freight operation in the corridor The bypasses in the southern part of the alignment avoid speed restrictions and reduced simulated trip time.	The length of this alignment is about the same as alignment Option C1B. It has one 50 mph (80 km/h) speed restriction and several 75 mph (120 km/h) speed restrictions. Dedicated VHS alignment	This alignment has the shortest simulated trip time. There are no 50 mph (80 km/h) speed restrictions. However, there are many 75 mph (120 km/h) speed restrictions. Dedicated VHS alignment	This option has the longest distance and the second longest trip times. Due to moderately steep grades, this option would only be suitable for dedicated VHS or maglev operation. Dedicated VHS alignment
	2	2	3	3	3
Construction Issues	Most of this alignment is unaffected, or has double tracking. The tunnel under San Juan Capistrano is challenging due to the narrow alignment, proximity to historic station, and nearby water crossings. Beach access issues at grade separations in San Clemente.	Similar to Option C1a, but with more tunnels. Tunnels are required under Orange and Dana Point to allow curve straightening. Tunnel in Orange affects the existing Metrolink station. Tunnel under I-5 in San Clemente, from Pico to Christianitos, due to rolling profile of freeway	General freeway construction issues (Option A1). Third level aerial construction along I-5 from Santa Ana River to SR-55, due to numerous overcrossings – HOV lane structures in the median may require rail system to straddle part of the freeway. Also at other freeway interchanges and in Oceanside. Tunnel under I-5 in San Clemente, from Las Ramblas to Christianitos, due to rolling profile of freeway.	General freeway construction issues (Option A1). SARC section highly constrained by flood control channel, power lines, & utility trunk lines. System must be in trench to pass beneath John Wayne Airport glide path Two long tunnel segments required under SR-73 alignment, due to sustained 6% grades in San Joaquin Hills Same as Option C2 from San Juan Capistrano to Oceanside.	General freeway construction issues (Option A1). Tunnel just north of Arroyo Trabuco due to steep grades. From Oso Parkway to I-5 (San Onofre) the corridor is one of several proposals being studied as an extension for SR-241, if highway is not built, then substantial earthwork required for this option. Same as Option C2 from Anaheim to Irvine and from San Onofre to Oceanside.
	4	3	1	2	3

1 2 3 4 5
Highly Unfavorable Highly Favorable

Evaluation Criteria	Alignment Option C1a	Alignment Option C1b	Alignment Option C2	Alignment Option C3	Alignment Option C4
Capital Cost	Least Cost	Moderate Cost	Very High Cost	Highest Cost	Very High Cost
	4	3	1	1	1
Right-of-Way Issues/Cost	Existing LOSSAN corridor, some widening required but new alignment is mostly in covered trench	Existing LOSSAN Corridor, some widening, other segments are trench or tunnel bypasses	Most of the freeway alignment from Anaheim to San Onofre is constrained Through Camp Pendleton, all land adjacent to I-5 could be subject to approval by the Department of the Navy.	Highly constrained along SARC and I-405. SR-73/I-5 alignments from Aliso Viejo to San Onofre are constrained. Through Camp Pendleton, all land adjacent to I-5 could be subject to approval by the Department of the Navy.	Freeway median constrained on I-5 through Santa Ana, Tustin, and Irvine. Open land on much of SR-241, south of Oso Parkway. Through Camp Pendleton, all land adjacent to I-5 could be subject to approval by the Department of the Navy.
	4	4	2	3	3
Maximize Compatibility with Existing and Planned Development.					
Land Use Compatibility and Conflicts	Low to medium density residential with mixture of commercial, industrial, and open space. Anaheim stadium, some parks, two military bases and San Juan Capistrano Mission and Historic Town Center Park is located along the alignment option.	Low to medium density residential with mixture of commercial, industrial, and open space. Anaheim stadium, some parks, two military bases and San Juan Capistrano Mission and Historic Town Center Park is located along the alignment option.	Low to medium density residential with mixture of commercial, industrial, and open space. Anaheim stadium, Disneyland theme park, city parks, two military bases and San Juan Capistrano Mission and Historic Town Center Park is located near the alignment option.	Land Uses are generally the same as described in Alignment Option C1a with the addition of John Wayne airport and large segments of open space along the corridor. South of the SR-73/I-5 interchange, land uses are the same as Option C2.	The alignment option transverses large agricultural lands and open space with large tracts of residential developments occurring along the corridor. There is also the San Onofre nuclear power plant and Camp Pendleton U.S. Marine Corps base.
	2	2	3	3	4

1 2 3 4 5
Highly Unfavorable Highly Favorable

Evaluation Criteria	Alignment Option C1a	Alignment Option C1b	Alignment Option C2	Alignment Option C3	Alignment Option C4
Visual Quality Impacts	Option is an existing alignment, at or below grade. Visual impacts vary from heavy urbanized areas of central Orange County to residential, open space, and farmland of southern Orange County. Views south of the Orange/San Diego County line is dominated by the Pacific Ocean to the West. Views in the vicinity of Camp Pendleton are of rolling hills of natural vegetation.	Visual impacts are similar to Option C1a. Bypasses are mostly in tunnel, reducing impact, but electrification has more impact in other locations.	Visual impacts are similar to Option C1a. New aerial structure added to I-5 alignment from Anaheim to Dana Point, and in Oceanside.	Introduction of aerial structure into freeway and full highway alignments, except at-grade in Camp Pendleton. Visual impacts along the Santa Ana River include riparian and natural wildlife habitat, and areas of residential and commercial adjacent to the River. The views from I-405 are of office and commercial development. Views from SR-73 are a mixture of residential and undeveloped open space. Some impacts mitigated by tunnels.	Introduction of aerial structure into freeway and full highway alignments, except at-grade in Camp Pendleton. Visual impacts from SR-241 are a mixture of residential and office/commercial developments. As the alignment transitions to the south, the view become less residential and more undeveloped open space and rolling hills of natural vegetation.
	3	3	2	3	2
Minimize Impacts to Natural Resources.					
Wetland Impacts	Wetland areas known to occur within this segment are 3 rivers, 2 washes, and 10 creeks.	Wetland areas known to occur within this segment are 3 rivers, 2 washes, and 10 creeks.	Wetland areas known to occur within this segment are 3 rivers, 1 channel, 2 washes, and 10 creeks.	Wetland areas known to occur within this segment are 3 rivers, 5 channels, 2 washes, and 13 creeks.	Wetland areas known to occur within this segment are 2 rivers, 1 channel, 1 reservoir, 1 lake, 2 washes, and 15 creeks.
	2	2	2	2	1
Water Resources	Impacts to 22 water resources.	Impacts to 22 water resources.	Impacts to 17 water resources.	Impacts to 14 water resources.	Impacts to 8 water resources.
	2	2	2	2	3
Floodplain Impacts	Crosses numerous floodplains.	Crosses numerous floodplains.	Crosses 4 floodplains	Crosses 4 floodplains	Crosses 4 floodplains
	2	2	2	2	2

1 2 3 4 5
Highly Unfavorable Highly Favorable

Evaluation Criteria	Alignment Option C1a	Alignment Option C1b	Alignment Option C2	Alignment Option C3	Alignment Option C4
Threatened & Endangered Species Impacts	There are 6 endangered, 2 threatened, and 19 species of special concern located within this option.	There are 6 endangered, 2 threatened, and 19 species of special concern located within this option.	There are 6 endangered, 2 threatened, and 19 species of special concern located within this option.	There is 1 endangered, 2 threatened, and 4 species of special concern located within this option.	There are 4 endangered, 2 threatened, and 15 species of special concern located within this option.
	2	2	2	3	2
Minimize Impacts to Social and Economic Resources.					
Environmental Justice Impacts (Demographics)	Potential impacts to a minority population of approximately 17,275 people. There are no potential impacts to any low-income households.	Potential impacts to a minority population of approximately 17,275 people. There are no potential impacts to any low-income households.	Potential impacts to a minority population of approximately 13,700 people. There are no potential impacts to any low-income households.	There are no potential impacts to any minority population or low-income households.	Potential impacts to a small minority population of approximately 50 people. There are no potential impacts to any low-income households.
	4	4	4	5	5
Community & Neighborhood Impacts	There are impacts to 13 communities and neighborhoods that occur within this alignment option.	There are impacts to 13 communities and neighborhoods that occur within this alignment option.	There are impacts to 15 communities and neighborhoods that occur within this alignment option.	There are impacts to 12 communities and neighborhoods that occur within this alignment option.	There are impacts to 5 communities and neighborhoods that occur within this alignment option. Fewest impacts, as much of the alignment is open land.
	2	3	3	3	4
Farmland Impacts	There are several parcels of farmland within Orange County. There is 1 parcel of Prime Farmland located within San Diego County.	There are several parcels of farmland within Orange County. There is 1 parcel of Prime Farmland located within San Diego County.	There are several parcels of farmland within Orange County. There is 1 parcel of Prime Farmland located within San Diego County.	There is 1 parcel of Farmland of Statewide Importance located within Orange County in the vicinity of SR-73.	There are several parcels of farmland within Orange and San Diego County.
	4	4	4	5	4

1 2 3 4 5
Highly Unfavorable Highly Favorable

Evaluation Criteria	Alignment Option C1a	Alignment Option C1b	Alignment Option C2	Alignment Option C3	Alignment Option C4
Minimize Impacts to Cultural Resources.					
Cultural Resources Impacts	There are several sites of cultural or historic significance that occur adjacent to this alignment option.	There are several sites of cultural or historic significance that occur adjacent to this alignment option.	There are several sites of cultural or historic significance that occur adjacent to this alignment option.	2 sites of cultural or historic significance occur along this alignment option.	There are several sites of cultural or historic significance that occur adjacent to this alignment option. There are no sites in the vicinity of planned segments of SR-241.
	2	3	3	4	3
Parks & Recreation/Wildlife Refuge Impacts	There are 23 Parks and Recreation/ Wildlife Refuge resources that occur within this alignment option.	There are 18 Parks and Recreation/ Wildlife Refuge resources that occur within this alignment option.	There are 2 Parks and Recreation/Wildlife Refuge resources that occur within this alignment option.	There are 7 Parks and Recreation/Wildlife Refuge resources that occur within this alignment option.	There are 2 Parks and Recreation/Wildlife Refuge resources that occur within this alignment option.
	1	2	4	3	4
Maximize Avoidance of Areas with Geologic and Soils Constraints.					
Soils/Slope Constraints	There are 9 distinct soil types. The alignment crosses areas with the potential for liquefaction and landslides.	The Soils and Slope Constraints are similar to Option C1a.	The Soils and Slope Constraints are similar to Option C1a.	The Soils and Slope Constraints are similar to Option C1a.	The Soils and Slope Constraints are similar to Option C1a.
	3	3	3	3	3
Seismic Constraints	Potential impacts from 1 major seismic area and fault. No faults are crossed.	The Seismic Constraints are similar to Option C1a.	The Seismic Constraints are similar to Option C1a.	The Seismic Constraints are similar to Option C1a.	The Seismic Constraints are similar to Option C1a.
	3	3	3	3	3

1 2 3 4 5
Highly Unfavorable Highly Favorable

Evaluation Criteria	Alignment Option C1a	Alignment Option C1b	Alignment Option C2	Alignment Option C3	Alignment Option C4
Maximize Avoidance of Areas with Potential Hazardous Materials.					
Hazardous Materials/Waste Constraints	Several hazardous waste sites located adjacent to corridor. Greatest concentration of sites located in the cities of Tustin and Santa Ana.	Several hazardous waste sites located adjacent to corridor. Greatest concentration of sites located in the cities of Tustin and Santa Ana. There are no known sites south of San Clemente along this alignment option.	Several hazardous waste sites located adjacent to corridor. Greatest concentration of sites located in the cities of Anaheim, Tustin, Irvine, and Mission Viejo. There are no known sites south of Mission Viejo along this alignment option.	No known hazardous waste sites.	No known hazardous waste sites.
	2	2	2	5	5

1 2 3 4 5
Highly Unfavorable Highly Favorable

Table 4.1-4
Los Angeles to San Diego via Orange County - High-Speed Train Alignment Evaluation Matrix
Segment D - Oceanside to San Diego

Evaluation Criteria	Alignment Option D1a	Alignment Option D1b	Alignment Option D2
Maximize Ridership/Revenue Potential.			
Travel Time *(Exp.=Express)*	(Local) OTC to: Solana Beach – 10.8 min UTC – 19.4 min Santa Fe Depot – 30.9 min (Exp.) OTC to: Santa Fe Depot – 24.5 min	(Local) OTC to: Solana Beach – 10 min Santa Fe Depot – 27.1 min (Exp.) OTC to: Santa Fe Depot – 23.2 min	(Local) Oceanside to: Solana Beach – 10.8 min San Diego Airport – 24.3 min (Exp.) Oceanside to: San Diego Airport – 21.4 min
	3	4	4
Length	37.3 miles (60.0 km)	35.8 miles (57.7 km)	33.8 miles (54.5 km)
	3	3	3
Population & Employment Catchment	See Solana Beach and UTC in Table 4.1-10, and Santa Fe Depot in Table 4.1-11	See Solana Beach in Table 4.1-10, and Santa Fe Depot in Table 4.1-11	See Solana Beach in Table 4.1-10, and San Diego Airport in Table 4.1-11
	3	3	3
Maximize Connectivity and Accessibility.			
Intermodal Connections	See Solana Beach and UTC in Table 4.1-10, and Santa Fe Depot in Table 4.1-11	See Solana Beach in Table 4.1-10, and Santa Fe Depot in Table 4.1-11	See Solana Beach in Table 4.1-10, and San Diego Airport in Table 4.1-11
	4	3	2
Minimize Operating and Capital Costs.			
Length	37.3 miles (60.0 km)	35.8 miles (57.7 km)	33.8 miles (54.5 km)
	3	3	3

1 2 3 4 5
Highly Unfavorable Highly Favorable

Evaluation Criteria	Alignment Option D1a	Alignment Option D1b	Alignment Option D2
Operational Issues	This alignment is the longest in this segment and has the longest trip time. Shared-Use, subject to delays from other rail traffic.	This alignment is shorter and has one 50 mph (80 km/h) speed restriction and several 75-100 mph (120-160 km/h) speed restrictions. The simulated trip time is substantially shorter. Shared-Use, bypasses would reduce delay compared with D1a.	The alignment characteristics are very similar to the Option D1b with identical simulated trip times. The alignment has many 75 mph (120 km/h) speed restrictions. Dedicated VHS alignment.
	2	3	4
Construction Issues	Completion of double tracking (at-grade) and stabilization and reinforcement at Del Mar Bluffs. Deep tunnel under Miramar Hill from Sorrento Valley to Rose Canyon.	Grade-separation of double tracked system in coastal cities. Trench construction in cities require transitions to/from grade at each Lagoon crossing. Some Coaster stations would need new platforms if tracks were lowered. Tunnel under Camino Del Mar difficult due to commercial/tourist area and traffic on highway. Second tunnel would follow I-5 alignment from north of Sorrento Valley Coaster to vicinity of Gilman Drive interchange Numerous grade crossings south of San Diego River Channel, trench required in approach to Santa Fe Depot due to airport runway.	General issues associated with a freeway alignment (See Option A1). Third level structures to clear arterial overpasses and freeway interchanges (SR-58, SR-56, I-805, SR-52, I-8) To avoid tunnel in Miramar Hill segment (road climbs at ~3.3% on north side), the option assumes very high structure above the arterials that crossover I-5.
	2	1	1
Capital Cost	Least Cost	Very High Cost	Very High Cost
	4	2	2

1 2 3 4 5
Highly Unfavorable Highly Favorable

Evaluation Criteria	Alignment Option D1a	Alignment Option D1b	Alignment Option D2
Right-of-Way Issues/Cost	Existing LOSSAN Corridor, with some widening, except for the new tunnel under UTC.	Existing LOSSAN Corridor, with some widening, except for the new tunnels at Del Mar and under I-5.	Highly constrained due to build out of I-5.
	3	3	1
Maximize Compatibility with Existing and Planned Development.			
Land Use Compatibility and Conflicts	Land uses are a mixture of agricultural, residential, and commercial with numerous state beaches, parks, and open space located along this alignment option.	Land uses are a mixture of agricultural, residential, and commercial with numerous state beaches, parks, and open space located along this alignment option.	Land uses are the same as described in Option D1a.
	2	3	2
Visual Quality Impacts	Widening of existing rail alignment. Views south of Oceanside are dominated by the Pacific Ocean to the west. There is a mixture of residential, commercial development, farmlands, and open space. In the vicinity of downtown San Diego, the views are of heavy urbanization.	Visual impacts similar to Option D1a, but impacts mitigated by grade-separation in coastal cities, and by tunnel at Del Mar.	Visual impacts similar to Option C2, impacts due to high aerial structure on I-5 alignment.
	2	3	3
Minimize Impacts to Natural Resources.			
Wetland Impacts	Wetland areas known to occur within this segment are 1 river, 1 river floodway, 4 lagoons, 5 creeks, and 1 bay.	Wetland areas known to occur within this segment are 1 river, 1 river floodway, 4 lagoons, 5 creeks, and one bay.	Wetland areas known to occur within this segment are 1 river, 1 river floodway, 4 lagoons, 8 creeks, and one bay.
	2	2	2
Water Resources	Impacts to 13 water resources.	Impacts to 13 water resources.	Impacts to 13 water resources.
	2	2	2

1 2 3 4 5
Highly Unfavorable Highly Favorable

Evaluation Criteria	Alignment Option D1a	Alignment Option D1b	Alignment Option D2
Floodplain Impacts	Crosses several 100-Year floodplains.	Crosses several 100-Year floodplains.	Crosses several 100-Year floodplains.
	2	2	2
Threatened & Endangered Species Impacts	There are 8 endangered, 5 threatened, and 24 species of special concern located within this option.	There are 8 endangered, 5 threatened, and 24 species of special concern located within this option.	There are 8 endangered, 5 threatened, and 24 species of special concern located within this option.
	1	1	1
Minimize Impacts to Social and Economic Resources.			
Environmental Justice Impacts (Demographics)	Potential impacts to minority population of approximately 5,250 people and potential impacts to approximately 45 low-income households.	Potential impacts to minority population of approximately 5,250 people and potential impacts to approximately 45 low-income households.	Potential impacts to minority population of approximately 8,950 people. There are no potential impacts to any low-income households.
	4	4	4
Community & Neighborhood Impacts	There are impacts to 7 communities and neighborhoods within this alignment option.	There are impacts to 7 communities and neighborhoods within this alignment option.	There are impacts to 7 communities and neighborhoods within this alignment option.
	2	3	3
Farmland Impacts	There are several parcels farmland located within San Diego County along this alignment option.	There are several parcels farmland located within San Diego County along this alignment option.	There are several parcels farmland located within San Diego County along this alignment option.
	3	3	3
Minimize Impacts to Cultural Resources.			
Cultural Resources Impacts	There are several sites of cultural or historic significance that occur adjacent to the alignment including the Carlsbad Village Depot and Old Town San Diego.	There are several sites of cultural or historic significance that occur adjacent to the alignment including the Carlsbad Village Depot and Old Town San Diego.	There are several sites of cultural or historic significance that occur adjacent to the alignment including the Carlsbad Village Depot and Old Town San Diego.
	2	2	2

1 2 3 4 5
Highly Unfavorable — Highly Favorable

Evaluation Criteria	Alignment Option D1a	Alignment Option D1b	Alignment Option D2
Parks & Recreation/Wildlife Refuge Impacts	There are 14 Parks and Recreation/Wildlife Refuge resources that occur within this alignment option.	There are 12 Parks and Recreation/Wildlife Refuge resources that occur within this alignment option.	There are 15 Parks and Recreation/Wildlife Refuge resources that occur within this alignment option.
	2	2	2
Maximize Avoidance of Areas with Geologic and Soils Constraints.			
Soils/Slope Constraints	There are 7 distinct soil types. The potential for liquefaction and landslides along the alignment option in the cities of Del Mar, Solana Beach, and Encinitas.	The Soils and Slope Constraints are similar to Option D1a.	The Soils and Slope Constraints are similar to Option D1a.
	2	3	3
Seismic Constraints	Potential impacts from 1 major seismic area and fault occur within this alignment option.	The Seismic Constraints are similar to Option D1a.	The Seismic Constraints are similar to Option D1a.
	2	2	2
Maximize Avoidance of Areas with Potential Hazardous Materials.			
Hazardous Materials/Waste Constraints	Several hazardous waste sites located adjacent to corridor. The sites are located in the cities of Oceanside, Carlsbad, Encinitas, and San Diego with the greatest concentration located within San Diego along the alignment.	Several hazardous waste sites located adjacent to corridor. The sites are located in the cities of Oceanside, Carlsbad, Encinitas, and San Diego with the greatest concentration located within San Diego along this alignment.	Several hazardous waste sites located adjacent to corridor in the cities of Oceanside and San Diego with the greatest concentration located within Diego along this alignment option.
	2	2	3

1 2 3 4 5
Highly Unfavorable — Highly Favorable

Table 4.1-5
Los Angeles to San Diego via Orange County - High-Speed Train Station Evaluation Matrix
LA Union Station to LAX

Evaluation Criteria	LAX	LA Union Station
Maximize Ridership/Revenue Potential.		
Travel Time	Refer to Options A1-A3 and A5	Refer to Options A1-A3 and B1-B4
Population & Employment Catchment *Data Based on 2020 Forecasts*	Population: 3,299,933 persons Employment: 1,837,949 persons	Population: 4,548,087 persons Employment: 2,021,767 persons
	3	5
Intermodal Connections	• I-405 • I-105 • Arterials • MTA Buses • Culver City Transit • Santa Monica Big Blue Bus • Torrance Transit *For details refer to Intermodal Connections in Section 4.1.1*	• LAX – 12 mi. (19.2 km) • I-110 • US-101 • Arterials • Amtrak • Amtrak Connection Buses • MTA Buses • LADOT DASH • Foothill Transit • MTA Rail • Metrolink *For details refer to Intermodal Connections in Section 4.1.1*
	4	5
Minimize Operating and Capital Costs.		
Operational Issues	No operational issues.	Shared-use with Amtrak, Metrolink, and statewide VHS/Maglev system.
	4	2
Construction Issues	Proximity to airport	*Refer to Los Angeles - Bakersfield Screening Evaluation Report.*
	2	2

Evaluation Criteria	LAX	LA Union Station
Capital Cost	New Terminal station	Existing Station; part of other corridors
	2	3
Right-of-Way Issues/Cost	Limited available land due to airport terminals, parking, flight path restrictions.	Existing station would be enlarged
	2	2
Maximize Compatibility with Existing and Planned Development.		
Land Use Compatibility and Conflicts	Land use is heavy commercial, industrial, and transportation related uses. Residential area to the east of proposed station site, across from I-405.	Land use is common to heavy urbanization of downtown urban centers with a mixture of heavy office space, light industrial, and mixed commercial use.
	4	4
Visual Quality Impacts	Visual impacts around proposed station include areas of heavy urbanization including mixed residential, commercial, industrial, and freeways. Few areas of open space and natural vegetation proposed station location.	Visual impacts around LA Union Station include areas of heavy urbanization including commercial, industrial, office space, and freeways. Few areas of open space and natural vegetation occur around LA Union Station.
	4	4
Minimize Impacts to Natural Resources.		
Wetland Impacts	No wetland impacts.	No wetland impacts.
	5	5
Water Resources	No water resource impacts.	No water resource impacts.
	5	5
Floodplain Impacts	No 100-year floodplain zone impacts.	No 100-year floodplain zone impacts.
	5	5

1 2 3 4 5
Highly Unfavorable Highly Favorable

Evaluation Criteria	LAX	LA Union Station
Threatened & Endangered Species Impacts	Impacts to 1 endangered species from this station.	No impacts to any sensitive species.
	5	5
Minimize Impacts to Social and Economic Resources.		
Environmental Justice Impacts (Demographics)	No known impacts to any minority population and no known impacts to low-income households.	Potential impacts to a minority population of approximately 22 people. No known impacts to low-income households.
	5	5
Community & Neighborhood Impacts	The cities of Los Angeles, Hawthorne and Inglewood and the communities of Lennox and Del Aire are impacted. Impacts to each city or community would depend upon proposed station site and location.	The City of Los Angeles and the downtown district of Chinatown are impacted. No impacts anticipated because LA Union Station is an operational rail station in current use.
	3	3
Farmland Impacts	No farmland impacts.	No farmland impacts.
	5	5
Minimize Impacts to Cultural Resources.		
Cultural Resources Impacts	No known cultural or historical sites.	3 cultural resources occur in the immediate vicinity.
	5	3
Parks & Recreation/Wildlife Refuge Impacts	No Parks or Recreation/Wildlife Refuge resources.	There is 1 Park that occurs in the immediate vicinity of the station.
	5	5

1 2 3 4 5
Highly Unfavorable — Highly Favorable

Evaluation Criteria	LAX	LA Union Station
Maximize Avoidance of Areas with Geologic and Soils Constraints.		
Soils/Slope Constraints	2 distinct soil types occur within the area of the proposed station. Possible impacts from liquefaction also occur in the immediate vicinity.	There is 1 distinct soil type. Possible impacts from liquefaction and landslides also occur in the immediate vicinity.
	3	3
Seismic Constraints	There are potential impacts from 3 major seismic areas and faults.	There are potential impacts from 3 major seismic areas and faults.
	3	3
Maximize Avoidance of Areas with Potential Hazardous Materials.		
Hazardous Materials/Waste Constraints	No known hazardous material/waste sites in the immediate vicinity.	No known hazardous material/waste sites in the immediate vicinity.
	5	5

1 2 3 4 5
Highly Unfavorable Highly Favorable

Table 4.1-6
Los Angeles to San Diego via Orange County - High-Speed Train Station Evaluation Matrix
LA Union Station to Central Orange County (Anaheim) – Southeast LA Stations

Evaluation Criteria	Norwalk - LOSSAN	Norwalk – Interstate 5	Norwalk – Union Pacific	Paramount
Maximize Ridership/Revenue Potential.				
Travel Time	Refer to Options A5, B1a, & B1b	Refer to Option B2	Refer to Option B4	Refer to Option B3
Population & Employment Catchment *Data Based on 2020 Forecasts*	Population: 3,085,202 persons Employment: 1,460,673 persons	Population: 3,230,260 persons Employment: 1,468,155 persons	Population: 3,269,933 persons Employment: 1,436,802 persons	Population: 3,713,693 persons Employment: 1,616,168 persons
	3	3	3	4
Maximize Connectivity and Accessibility.				
Intermodal Connections	• Long Beach Aprt – 8mi. (12.8 km) • I-5 • Arterials • Amtrak • MTA Buses • Norwalk Transit • Metrolink *For details refer to Intermodal Connections in Section 4.1.2*	• Long Beach Aprt – 8mi. (12.8 km) • I-5 • Arterials • MTA Buses • Norwalk Transit *For details refer to Intermodal Connections in Section 4.1.2*	• Long Beach Aprt – 7mi. (11.2 km) • I-5 • I-605 • I-105 • Arterials • MTA Buses • Norwalk Transit *For details refer to Intermodal Connections in Section 4.1.2*	• Long Beach Aprt – 6mi. (9.6 km) • I-105 • I-710 • Arterials • MTA Buses • *Potential LRT station - MTA Green Line* *For details refer to Intermodal Connections in Section 4.1.2*
	5	4	4	4
Minimize Operating and Capital Costs.				
Operational Issues	Shared-use with Amtrak and Metrolink	Dedicated Station (New)	Dedicated Station (New)	Dedicated Station (New)
	3	4	4	4
Construction Issues	Expansion of existing station	Aerial station above I-5 Freeway	Trench platforms, station at grade	Aerial station with potential connection to light rail station in I-105 trench.
	4	3	3	2
Capital Cost	Some cost offset by existing station.	New station	New station	New station + Green Line platform
	4	3	3	2

Evaluation Criteria	Norwalk - LOSSAN	Norwalk – Interstate 5	Norwalk – Union Pacific	Paramount
Right-of-Way Issues/Cost	Existing facility, nearby vacant land	Constrained by freeway	Constrained by residential area to south.	Constrained by wide freeway trench below station.
	3	2	2	2
Maximize Compatibility with Existing and Planned Development.				
Land Use Compatibility and Conflicts	Land use is heavy urbanization with a mixture of residential, commercial, and light industrial.	Land use is heavy urbanization with a mixture of residential, commercial, and light industrial.	Land use is heavy urbanization with a mixture of residential, commercial, and light industrial.	Land use is heavy urbanization with a mixture of residential, commercial, and industrial.
	4	3	3	2
Visual Quality Impacts	Visual impacts around proposed station include areas of heavy urbanization including mixed residential, commercial, industrial, utility lines and freeways. Few areas of open space and natural vegetation in the vicinity of the proposed station location.	Visual impacts around proposed station include areas of heavy urbanization including mixed residential, commercial, industrial, utility lines and freeways. Few areas of open space and natural vegetation in the vicinity of the proposed station location.	Visual impacts around proposed station include areas of heavy urbanization including mixed residential, commercial, industrial, utility lines and freeways. Few areas of open space and natural vegetation in the vicinity of the proposed station location.	Visual impacts around proposed station include areas of heavy urbanization including mixed residential, commercial, industrial, utility lines and freeways. Few areas of open space and natural vegetation in the vicinity of the proposed station location.
	4	3	3	2
Minimize Impacts to Natural Resources.				
Wetland Impacts	No wetland impacts.	No wetland impacts.	No wetland impacts.	No wetland impacts.
	5	5	5	5
Water Resources	No water resource impacts.	No water resource impacts.	No water resource impacts.	No water resource impacts.
	5	5	5	5
Floodplain Impacts	No floodplain impacts.	No floodplain impacts.	No floodplain impacts.	No floodplain impacts.
	5	5	5	5
Threatened & Endangered Species Impacts	No impacts to any sensitive species.	No impacts to any sensitive species.	No impacts to any sensitive species.	No impacts to any sensitive species.
	5	5	5	5

1 2 3 4 5
Highly Unfavorable — Highly Favorable

Evaluation Criteria	Norwalk - LOSSAN	Norwalk – Interstate 5	Norwalk – Union Pacific	Paramount
Minimize Impacts to Social and Economic Resources.				
Environmental Justice Impacts (Demographics)	Potential impacts to a minority population of approximately 3,300 people and known impacts to 5 low-income households.	Potential impacts to a minority population of approximately 2,800 people. No known impacts to any low-income households.	Potential impacts to a minority population of approximately 2,800 people and known impacts to 5 low-income households.	Potential impacts to a minority population of approximately 3,250 people. No known impacts to any low-income households.
	2	2	2	2
Community & Neighborhood Impacts	The cities of Norwalk and Santa Fe Springs would be impacted. Impacts to either city would depend upon proposed station site and location.	The cities of Norwalk and Santa Fe Springs would be impacted. Impacts to either city would depend upon proposed station site and location.	The cities of Norwalk and Santa Fe Springs would be impacted. Impacts to either city would depend upon proposed station site and location.	The cities of Paramount and South Gate and the community of Hollydale would be impacted. Impacts to either city would depend upon proposed station site and location.
	4	3	3	2
Farmland Impacts	No farmland impacts.	No farmland impacts.	No farmland impacts.	No farmland impacts.
	5	5	5	5
Minimize Impacts to Cultural Resources.				
Cultural Resources Impacts	No cultural resources.	No cultural resources.	No cultural resources.	No cultural resources.
	5	5	5	5
Parks & Recreation/Wildlife Refuge Impacts	No Parks orRecreation/Wildlife Refuge resources.	No Parks orRecreation/Wildlife Refuge resources.	No Parks orRecreation/Wildlife Refuge resources.	No Parks orRecreation/Wildlife Refuge resources.
	5	5	5	5
Maximize Avoidance of Areas with Geologic and Soils Constraints.				
Soils/Slope Constraints	There is 1 distinct soil type. Possible impacts from liquefaction in the immediate vicinity.	There is 1 distinct soil type. Possible impacts from liquefaction in the immediate vicinity.	There is 1 distinct soil type. Possible impacts from liquefaction in the immediate vicinity.	There is 1 distinct soil type. Possible impacts from liquefaction in the immediate vicinity.
	3	3	3	3

1 2 3 4 5
Highly Unfavorable — Highly Favorable

Evaluation Criteria	Norwalk - LOSSAN	Norwalk – Interstate 5	Norwalk – Union Pacific	Paramount
Seismic Constraints	There are potential impacts from 3 major seismic areas and faults.	There are potential impacts from 3 major seismic areas and faults.	There are potential impacts from 3 major seismic areas and faults.	There are potential impacts from 3 major seismic areas and faults.
	3	3	3	3
Maximize Avoidance of Areas with Potential Hazardous Materials.				
Hazardous Materials/Waste Constraints	There are 2 known hazardous material/waste sites in the immediate vicinity.	No known hazardous material/waste sites.	No known hazardous material/waste sites.	No known hazardous material/waste sites.
	4	5	5	5

1 2 3 4 5
Highly Unfavorable Highly Favorable

Table 4.1-7
Los Angeles to San Diego via Orange County - High-Speed Train Station Evaluation Matrix
LA Union Station to Central Orange County (Anaheim) – Central Orange County Stations

Evaluation Criteria	Anaheim - LOSSAN	Anaheim – Interstate 5	Garden Grove
Maximize Ridership/Revenue Potential.			
Travel Time	Refer to Options B1a and B1b	Refer to Options B2 and B4	Refer to Option B3
Population & Employment Catchment *Data Based on 2020 Forecasts*	Population: 2,456,616 persons Employment: 1,455,235 persons 3	Population: 2,588,844 persons Employment: 1,484,922 persons 3	Population: 2,628,764 persons Employment: 1,546,843 persons 3
Maximize Connectivity and Accessibility.			
Intermodal Connections	• John Wayne – 9mi. (14.4 km) • I-5 • SR-57 • Arterials • Amtrak • OCTA Buses • Anaheim Resort Shuttles • Metrolink *For details refer to Intermodal Connections in Section 4.1.2* 5	• John Wayne – 8.5mi. (13.6 km) • I-5 • Arterials • OCTA Buses *For details refer to Intermodal Connections in Section 4.1.2* 4	• John Wayne – 6.5mi. (10.4 km) • SR-22 • Arterials • OCTA Buses *For details refer to Intermodal Connections in Section 4.1.2* 3
Minimize Operating and Capital Costs.			
Operational Issues	Shared-use with Amtrak and Metrolink. 3	New VHS/Maglev Station 4	New VHS/Maglev Station 4
Construction Issues	Expand existing station, replace station building. 4	New station - aerial 3	New station - below grade platforms. 3
Capital Cost	Some cost off set by existing station. 4	New station - aerial platforms 2	New station - below grade platforms. 2

Evaluation Criteria	Anaheim - LOSSAN	Anaheim – Interstate 5	Garden Grove
Right-of-Way Issues/Cost	Existing facility; nearby parking lot	Constrained ROW	Constrained ROW
	4	2	2
Maximize Compatibility with Existing and Planned Development.			
Land Use Compatibility and Conflicts	Land use is mixed commercial, light industrial, office space, and recreational with some areas of open space.	Land use is mixed commercial, light industrial, office space, and recreational with some areas of open space.	Land use is mixed commercial, light industrial, office space with some areas of open space, and residential.
	4	3	2
Visual Quality Impacts	Visual impacts around proposed station include areas of urbanization including mixed commercial, industrial, utility lines, freeways and Anaheim stadium. Few areas of open space and natural vegetation in the vicinity of the proposed station location except for along the Santa Ana river.	Visual impacts around proposed station include areas of urbanization including mixed commercial, industrial, utility lines, freeways, Anaheim stadium and The Block of Orange. Few areas of open space and natural vegetation in the vicinity of the proposed station location except for along the Santa Ana river.	Visual impacts around proposed station include areas of urbanization including mixed residential, commercial, industrial, utility lines, and freeways. Few areas of open space and natural vegetation in the vicinity of the proposed station location except for along the Santa Ana river.
	4	3	2
Minimize Impacts to Natural Resources.			
Wetland Impacts	No wetland impacts.	No wetland impacts.	No wetland impacts.
	5	5	5
Water Resources	No water resource impacts.	No water resource impacts.	No water resource impacts.
	5	5	5
Floodplain Impacts	There is 1 floodplain impacted.	There is 1 floodplain impacted.	There is 1 floodplain impacted.
	3	3	3
Threatened & Endangered Species Impacts	Impact to San Fernando Valley Spineflower.	Impact to San Fernando Valley Spineflower.	Impact to San Fernando Valley Spineflower.
	4	4	4

Evaluation Criteria	Anaheim - LOSSAN	Anaheim – Interstate 5	Garden Grove
Minimize Impacts to Social and Economic Resources.			
Environmental Justice Impacts (Demographics)	No known impacts to any minority population or low-income households.	Potential impacts to a minority population of approximately 3,200 people. No known impacts to any low-income households.	Potential impacts to a minority population of approximately 8,000 people. No known impacts to any low-income households.
	5	4	2
Community & Neighborhood Impacts	The City of Anaheim would be impacted.	The City of Anaheim would be impacted.	The City of Garden Grove would be impacted.
	4	3	2
Farmland Impacts	No farmland impacts.	No farmland impacts.	No farmland impacts.
	5	5	5
Minimize Impacts to Cultural Resources.			
Cultural Resources Impacts	No known cultural resources.	No known cultural resources.	No known cultural resources.
	5	5	5
Parks & Recreation/Wildlife Refuge Impacts	No parks and recreation/wildlife refuge resources.	No parks and recreation/wildlife refuge resources.	No parks and recreation/wildlife refuge resources.
	5	5	5
Maximize Avoidance of Areas with Geologic and Soils Constraints.			
Soils/Slope Constraints	There is 1 distinct soil type. Possible impacts from liquefaction.	There is 1 distinct soil type. Possible impacts from liquefaction.	There is 1 distinct soil type. Possible impacts from liquefaction.
	3	3	3
Seismic Constraints	Potential impacts from 2 major seismic areas and faults.	Potential impacts from 2 major seismic areas and faults.	Potential impacts from 2 major seismic areas and faults.
	3	3	3

1 2 3 4 5
Highly Unfavorable Highly Favorable

Evaluation Criteria	Anaheim - LOSSAN	Anaheim – Interstate 5	Garden Grove
Maximize Avoidance of Areas with Potential Hazardous Materials.			
Hazardous Materials/Waste Constraints	There is 1 known hazardous material/waste site in the immediate vicinity. 4	No known hazardous material/waste sites. 5	There is 1 known hazardous material/waste site in the immediate vicinity. 4

1 2 3 4 5
Highly Unfavorable Highly Favorable

Table 4.1-8
Los Angeles to San Diego via Orange County - High-Speed Train Station Evaluation Matrix
Central Orange County (Anaheim) to Oceanside – Southern Orange County Stations

Evaluation Criteria	Irvine – LOSSAN	Irvine – Interstate 5	Newport Beach
Maximize Ridership/Revenue Potential.			
Travel Time	Refer to Options C1a and C1b	Refer to Options C2 and C4	Refer to Option C3
Population & Employment Catchment *Data Based on 2020 Forecasts*	Population: 1,307,800 persons Employment: 906,503 persons	Population: 1,618,714 persons Employment: 1,149,916 persons	Population: 1,705,610 persons Employment: 1,200,373 persons
	3	3	4
Maximize Connectivity and Accessibility.			
Intermodal Connections	• John Wayne – 7.5mi (12 km) • I-5 • Arterials • Amtrak • OCTA Buses • Metrolink *For details refer to Intermodal Connections in Section 4.1.3*	• John Wayne – 5.5mi. (8.8 km) • I-5 • I-405 • Arterials • OCTA Buses *For details refer to Intermodal Connections in Section 4.1.3*	• John Wayne – 1.5 mi (2.9 km) • SR-73 • Arterials • OCTA Buses *For details refer to Intermodal Connections in Section 4.1.3*
	4	3	2
Minimize Operating and Capital Costs.			
Operational Issues	Shared-use with Amtrak and Metrolink.	New VHS/Maglev station	New VHS/Maglev station
	3	4	4
Construction Issues	Existing station, but potential flight path restrictions (El Toro) on structures.	New aerial station; nearby freeway interchanges	Location on curve and in a trench; is a challenge; nearby freeway ramps and drainage channel in vicinity.
	4	3	2

1 2 3 4 5
Highly Unfavorable Highly Favorable

Evaluation Criteria	Irvine – LOSSAN	Irvine – Interstate 5	Newport Beach
Capital Cost	Existing station off sets some costs	New station - aerial	New station; site complicated by roads and drainage channel at site.
	4	3	2
Right-of-Way Issues/Cost	Existing site, plus new land	New land; proximity to "Old town Irvine" a potential issue.	Highly constrained by freeway & arterial roads.
	4	3	2
Maximize Compatibility with Existing and Planned Development.			
Land Use Compatibility and Conflicts	Land use is mixed residential, commercial, light industrial, office space, with some areas of open space and farmland.	Land use is mixed residential, commercial, light industrial, office space, with some areas of open space and farmland.	Land use is mixed residential, commercial, office space, with some areas of open space and recreational uses.
	4	3	2
Visual Quality Impacts	Visual impacts around proposed station include residential, mixed commercial, industrial, freeways. Areas of open space, natural vegetation, and farmland in the vicinity of the proposed station location.	Visual impacts around proposed station include residential, mixed commercial, industrial, freeways. Areas of open space, natural vegetation, and farmland in the vicinity of the proposed station location.	Visual impacts around proposed station include mixed residential, commercial, office space, and freeways. Areas of open space, natural vegetation, and Newport Back Bay are in the vicinity of the proposed station location.
	4	3	2
Minimize Impacts to Natural Resources.			
Wetland Impacts	No wetland impacts.	No wetland impacts.	No wetland impacts.
	5	5	5
Water Resources	No water resource impacts.	No water resource impacts.	No water resource impacts.
	5	5	5
Floodplain Impacts	There is 1 100-year floodplain zone impact.	There is 1 100-year floodplain zone impact.	No floodplain impacts.
	4	4	5

1 2 3 4 5
Highly Unfavorable Highly Favorable

Evaluation Criteria	Irvine – LOSSAN	Irvine – Interstate 5	Newport Beach
Threatened & Endangered Species Impacts	No impacts to any sensitive species.	No impacts to any sensitive species.	Impacts to 3 threatened or endangered species or species of special concern.
	5	5	2
Minimize Impacts to Social and Economic Resources.			
Environmental Justice Impacts (Demographics)	No known impacts to any minority population or low-income households.	No known impacts to any minority population or low-income households.	No known impacts to any minority population or low-income households.
	5	5	5
Community & Neighborhood Impacts	The City of Irvine would be impacted.	The City of Irvine would be impacted.	The City of Newport Beach and community of Santa Ana Heights would be impacted.
	4	4	2
Farmland Impacts	No farmland impacts.	Impacts to several parcels of Prime Farmland.	No farmland impacts.
	5	4	5
Minimize Impacts to Cultural Resources.			
Cultural Resources Impacts	No known cultural resources.	No known cultural resources.	No known cultural resources.
	5	5	5
Parks & Recreation/Wildlife Refuge Impacts	No parks or recreation/wildlife refuge resources.	No parks or recreation/wildlife refuge resources.	No parks or recreation/wildlife refuge resources.
	5	5	5
Maximize Avoidance of Areas with Geologic and Soils Constraints.			
Soils/Slope Constraints	There is 1 distinct soil type. Possible impacts from liquefaction.	There is 1 distinct soil type. Possible impacts from liquefaction.	There is 1 distinct soil type. Possible impacts from liquefaction.
	3	3	3

1 2 3 4 5
Highly Unfavorable Highly Favorable

Evaluation Criteria	Irvine – LOSSAN	Irvine – Interstate 5	Newport Beach
Seismic Constraints	Potential impacts from 1 major seismic area and fault.	Potential impacts from 1 major seismic area and fault.	Potential impacts from one major seismic area and fault.
	3	3	3
Maximize Avoidance of Areas with Potential Hazardous Materials.			
Hazardous Materials/Waste Constraints	No known hazardous material/waste sites.	No known hazardous material/waste sites.	No known hazardous material/waste sites.
	5	5	5

1 2 3 4 5
Highly Unfavorable Highly Favorable

Table 4.1-9
Los Angeles to San Diego via Orange County - High-Speed Train Station Evaluation Matrix
Central Orange County (Anaheim) to Oceanside – North San Diego County Stations

Evaluation Criteria	Oceanside - LOSSAN	Oceanside– Interstate 5
Maximize Ridership/Revenue Potential.		
Travel Time	Refer to Options C1a and C1b	Refer to Options C2 - C4
Population & Employment Catchment *Data Based on 2020 Forecasts*	Population: 458,045 persons Employment: 259,653 persons	Population: 507,306 persons Employment: 273,692 persons
	2	2
Maximize Connectivity and Accessibility.		
Intermodal Connections	• Lindbergh – 34mi. (54.4 km) • I-5 • Arterials • NCTD Buses • Amtrak • Coaster • Metrolink • *NCTD Oceanside/Escondido LRT* *For details refer to Intermodal Connections in Section 4.1.3*	• Lindbergh – 33mi. (52.8 km) • I-5 • Arterials • NCTD Buses • *Potential LRT station - NCTD Oceanside/Escondido Line* *For details refer to Intermodal Connections in Section 4.1.3*
	4	3
Minimize Operating and Capital Costs.		
Operational Issues	Shared-use with Amtrak, Coaster, and Metrolink	New VHS/Maglev station
	3	4
Construction Issues	New tracks; and one configuration has depressed alignment.	New station - aerial
	4	3

1 2 3 4 5
Highly Unfavorable — Highly Favorable

Evaluation Criteria	Oceanside - LOSSAN	Oceanside– Interstate 5
Capital Cost	Existing station off sets some costs.	New station - aerial
	4	3
Right-of-Way Issues/Cost	Constrained by tracks for future Oceanside-Escondido LRT.	I-5 bordered by private property
	3	3
Maximize Compatibility with Existing and Planned Development.		
Land Use Compatibility and Conflicts	Land use is mixed residential, commercial, office space, with some areas of open space and recreational uses.	Land use is mixed residential, commercial, office space, with some areas of open space and recreational uses.
	4	3
Visual Quality Impacts	View impacts around proposed station include residential, mixed commercial, and I-5 freeway. Some areas of open space, natural vegetation, beaches, and the Pacific Ocean dominate the views in the vicinity of the proposed station location.	View impacts around proposed station include residential, mixed commercial, and I-5 freeway. Some areas of open space, natural vegetation, beaches, and the Pacific Ocean dominate the views in the vicinity of the proposed station location.
	3	2
Minimize Impacts to Natural Resources.		
Wetland Impacts	Impact to 1 wetland.	Impacts to 1 wetland.
	3	3
Water Resources	No water resource impacts.	No water resource impacts.
	5	5
Floodplain Impacts	There is 1 100-year floodplain zone impacted.	There is 1 100-year floodplain zone impacted.
	3	3

1 2 3 4 5
Highly Unfavorable Highly Favorable

Evaluation Criteria	Oceanside - LOSSAN	Oceanside– Interstate 5
Threatened & Endangered Species Impacts	Impact to 1 threatened or endangered species or species of special concern.	Impact to 1 threatened or endangered species or species of special concern.
	4	4
Minimize Impacts to Social and Economic Resources.		
Environmental Justice Impacts (Demographics)	Potential impacts to a minority population of approximately 300 people. No known impacts to any low-income households.	Potential impacts to a minority population of approximately 650 people. No known impacts to any low-income households.
	4	3
Community & Neighborhood Impacts	The City of Oceanside would be impacted.	The City of Oceanside would be impacted.
	3	3
Farmland Impacts	No farmland impacts.	No farmland impacts.
	5	5
Minimize Impacts to Cultural Resources.		
Cultural Resources Impacts	There is 1 known cultural resource in the immediate vicinity.	There is 1 known cultural resource in the immediate vicinity.
	3	3
Parks & Recreation/Wildlife Refuge Impacts	No parks or recreation/wildlife refuge resources.	No parks or recreation/wildlife refuge resources.
	5	5

1 2 3 4 5
Highly Unfavorable Highly Favorable

Evaluation Criteria	Oceanside - LOSSAN	Oceanside– Interstate 5
Maximize Avoidance of Areas with Geologic and Soils Constraints.		
Soils/Slope Constraints	There is 1 distinct soil type. Possible impacts from liquefaction occur in the immediate vicinity.	There is 1 distinct soil type. Possible impacts from liquefaction occur in the immediate vicinity.
	3	3
Seismic Constraints	Potential impacts from 1 major seismic area and fault.	Potential impacts from 1 major seismic area and fault.
	3	3
Maximize Avoidance of Areas with Potential Hazardous Materials.		
Hazardous Materials/Waste Constraints	There is 1 known hazardous material/waste site in the immediate vicinity.	No known hazardous material/waste sites.
	4	5

1 2 3 4 5
Highly Unfavorable Highly Favorable

Table 4.1-10
Los Angeles to San Diego via Orange County - High-Speed Train Station Evaluation Matrix
Oceanside to San Diego – Central San Diego County Stations

Evaluation Criteria	Solana Beach - LOSSAN	Solana Beach – Interstate 5	University Towne Centre
Maximize Ridership/Revenue Potential.			
Travel Time	Refer to Options D1a and D1b	Refer to Option D2	Refer to Option D1a
Population & Employment Catchment *Data Based on 2020 Forecasts*	Population: 496,489 persons Employment: 305,176 persons	Population: 560,328 persons Employment: 348,080 persons	Population: 888,420 persons Employment: 549,639 persons
	2	2	2
Maximize Connectivity and Accessibility.			
Intermodal Connections	• SD Airport – 17mi. (27.2 km) • I-5 • Arterials • NCTD Buses • Coaster • Amtrak *For details refer to Intermodal Connections in Section 4.1.4*	• SD Airport – 17mi. (27.2 km) • I-5 • NCTD Buses *For details refer to Intermodal Connections in Section 4.1.4*	• SD Airport – 9.5mi. (15.2 km) • I-5 • Arterials • NCTD Buses • MTDB Buses • *Potential LRT station - San Diego Trolley* *For details refer to Intermodal Connections in Section 4.1.4*
	3	2	4
Minimize Operating and Capital Costs.			
Operational Issues	Shared-use	New VHS/Maglev station	New VHS/Maglev station - Shared-use
	3	4	3
Construction Issues	Station platforms already in a trench; difficult to widen for more tracks.	Narrow I-5 median; little ROW	Station in deep tunnel under UTC.
	2	3	1

1 2 3 4 5
Highly Unfavorable — Highly Favorable

Evaluation Criteria	Solana Beach - LOSSAN	Solana Beach – Interstate 5	University Towne Centre
Capital Cost	Partially off set by existing station	New station - aerial	Highest capital cost of the 3 options because station is in a tunnel.
	3	2	1
Right-of-Way Issues/Cost	Partially off set by existing station	Narrow I-5 median; little ROW	Tunnel below public streets.
	3	2	3
Maximize Compatibility with Existing and Planned Development.			
Land Use Compatibility and Conflicts	Land use is mixed residential and commercial with some areas of open space and recreational uses.	Land use is mixed residential and commercial with some areas of open space and recreational uses.	Land use is mixed residential, light industrial and commercial, and areas of open space.
	4	2	3
Visual Quality Impacts	View impacts around proposed station include residential, light commercial, and I-5 freeway. Some areas of open space, natural vegetation, beaches, and the Pacific Ocean dominate the views in the vicinity of the proposed station location.	View impacts around proposed station include residential, light commercial, and I-5 freeway. Some areas of open space, natural vegetation, beaches, and the Pacific Ocean dominate the views in the vicinity of the proposed station location.	View impacts around proposed station include mixed residential, and I-5 freeway. Areas of open space, natural vegetation, rolling hills, beaches, and the Pacific Ocean dominate the views in the vicinity of the proposed station location. The station is in close proximity to the UCSD campus.
	4	2	3
Minimize Impacts to Natural Resources.			
Wetland Impacts	No wetland impacts.	Impact to 1 wetland.	No wetland impacts.
	5	3	5
Water Resources	No water resource impacts.	No water resource impacts.	No water resource impacts.
	5	5	5
Floodplain Impacts	No floodplain impacts.	There is 1 100-year floodplain zone impact.	No floodplain impacts.
	5	3	5

1 2 3 4 5
Highly Unfavorable Highly Favorable

Evaluation Criteria	Solana Beach - LOSSAN	Solana Beach – Interstate 5	University Towne Centre
Threatened & Endangered Species Impacts	No impacts to any sensitive species.	No impacts to any sensitive species.	Impacts to two threatened or endangered species or species of special concern.
	5	5	3
Minimize Impacts to Social and Economic Resources.			
Environmental Justice Impacts (Demographics)	No known impacts to any minority population or low-income households.	No known impacts to any minority population or low-income households.	No known impacts to any minority population or low-income households.
	5	5	5
Community & Neighborhood Impacts	Solana Beach and Eden Gardens would be impacted.	Solana Beach and Eden Gardens would be impacted.	The City of San Diego and the community of University City would be impacted.
	3	3	3
Farmland Impacts	No farmland impacts.	No farmland impacts.	No farmland impacts.
	5	5	5
Minimize Impacts to Cultural Resources.			
Cultural Resources Impacts	There is 1 cultural resource in the immediate vicinity.	There is 1 cultural resource in the immediate vicinity.	There is 1 cultural resource in the immediate vicinity.
	3	3	3
Parks & Recreation/Wildlife Refuge Impacts	No parks or recreation/wildlife refuge resources.	No parks or recreation/wildlife refuge resources.	No parks or recreation/wildlife refuge resources.
	5	5	5

1 2 3 4 5
Highly Unfavorable Highly Favorable

Evaluation Criteria	Solana Beach - LOSSAN	Solana Beach – Interstate 5	University Towne Centre
Maximize Avoidance of Areas with Geologic and Soils Constraints.			
Soils/Slope Constraints	There is 1 distinct soil type. Possible impacts from liquefaction occur in the immediate vicinity.	There is 1 distinct soil type. Possible impacts from liquefaction occur in the immediate vicinity.	There is 1 distinct soil type. Possible impacts from liquefaction occur in the immediate vicinity.
	3	3	3
Seismic Constraints	Potential impacts from 1 major seismic area and fault.	Potential impacts from 1 major seismic area and fault.	Potential impacts from 1 major seismic area and fault.
	3	3	2
Maximize Avoidance of Areas with Potential Hazardous Materials.			
Hazardous Materials/Waste Constraints	No known hazardous material/waste sites.	No known hazardous material/waste sites.	No known hazardous material/waste sites.
	5	5	5

1 2 3 4 5
Highly Unfavorable Highly Favorable

Table 4.1-11
Los Angeles to San Diego via Orange County - High-Speed Train Station Evaluation Matrix
Oceanside to San Diego – Downtown / Airport Stations

Evaluation Criteria	Santa Fe Depot	San Diego Airport
Maximize Ridership/Revenue Potential.		
Travel Time	Refer to Options D1a and D1b	Refer to Option D2
Population & Employment Catchment *Data Based on 2020 Forecasts*	Population: 1,262,755 persons Employment: 661,334 persons	Population: 1,311,448 persons Employment: 698,369 persons
	4	4
Maximize Connectivity and Accessibility.		
Intermodal Connections	• SD Airport – 1.5mi. (2.4 km) • I-5 • Arterials • MTDB Buses • San Diego Trolley • Amtrak • Coaster *For details refer to Intermodal Connections in Section 4.1.4*	• SD Airport – 1 mi. (1.6 km) • I-5 • Arterials • MTDB Buses • San Diego Trolley *For details refer to Intermodal Connections in Section 4.1.4*
	4	3
Minimize Operating and Capital Costs.		
Operational Issues	Shared-use with Amtrak and Coaster	New VHS/Maglev; optional LOSSAN site.
	3	4
Construction Issues	Existing historic station; existing hub for local transit including light-rail. Under Option D1b, VHS train platforms would be below grade.	Aerial station, challenge is proximity to I-5 and the San Diego Trolley station.
	2	3

Evaluation Criteria	Santa Fe Depot	San Diego Airport
Capital Cost	Partial off set by existing station.	New station
	4	3
Right-of-Way Issues/Cost	Partial off set by existing station.	New station in highly constrained area.
	4	2
Maximize Compatibility with Existing and Planned Development.		
Land Use Compatibility and Conflicts	Land use is common to heavy urbanized downtown areas with a mixture of residential, commercial, industrial, heavy office space, and transportation centers.	Land use is common to heavy urbanized downtown areas with a mixture of residential, commercial, industrial, heavy office space, and transportation centers.
	4	4
Visual Quality Impacts	Visual impacts around proposed station are heavy urbanization including mixed residential, commercial, industrial, and utility lines. No areas of open space or natural vegetation. San Diego Bay and the Pacific Ocean dominate the view to the west.	Visual impacts around proposed station are heavy urbanization including mixed residential, commercial, industrial, and utility lines. No areas of open space or natural vegetation. San Diego Bay and the Pacific Ocean dominate the view to the west.
	3	3
Minimize Impacts to Natural Resources.		
Wetland Impacts	No wetland impacts.	No wetland impacts.
	5	5
Water Resources	No water resource impacts.	No water resource impacts.
	5	5
Floodplain Impacts	No floodplain impacts.	No floodplain impacts.
	5	5

1 2 3 4 5
Highly Unfavorable Highly Favorable

Evaluation Criteria	Santa Fe Depot	San Diego Airport
Threatened & Endangered Species Impacts	No impacts to any sensitive species.	No impacts to any sensitive species.
	5	5
Minimize Impacts to Social and Economic Resources.		
Environmental Justice Impacts (Demographics)	No known impacts to any minority population or low-income households.	Potential impacts to minority population of approximately 500 people. No known impacts to any low-income households.
	5	4
Community & Neighborhood Impacts	The City of San Diego, Old Town, and Loma Portal would be impacted.	The City of San Diego and Middle Town would be impacted.
	4	4
Farmland Impacts	No farmland impacts.	No farmland impacts.
	5	5
Minimize Impacts to Cultural Resources.		
Cultural Resources Impacts	There are several cultural resources that occur in the immediate vicinity.	There is one cultural resource that occurs in the immediate vicinity.
	3	4
Parks & Recreation/Wildlife Refuge Impacts	No parks or recreation/wildlife refuge resources.	No parks or recreation/wildlife refuge resources.
	5	5
Maximize Avoidance of Areas with Geologic and Soils Constraints.		
Soils/Slope Constraints	One distinct soil type occurs within the area of the proposed station. Possible impacts from liquefaction occur in the immediate vicinity of the proposed station.	One distinct soil type occurs within the area of the proposed station. Possible impacts from liquefaction occur in the immediate vicinity of the proposed station.
	3	3

1 2 3 4 5
Highly Unfavorable — Highly Favorable

Evaluation Criteria	Santa Fe Depot	San Diego Airport
Seismic Constraints	Potential impacts from 1 major seismic area and fault.	Potential impacts from 1 major seismic area and fault.
	3	3
Maximize Avoidance of Areas with Potential Hazardous Materials.		
Hazardous Materials/Waste Constraints	No known hazardous material/waste sites.	There are 2 known hazardous material/waste sites in the immediate vicinity.
	5	4

1 2 3 4 5
Highly Unfavorable Highly Favorable

5.0 REFERENCES

Parsons Brinckerhoff. *California Passenger Rail System 20-Year Improvement Plan*. Prepared for Amtrak. March 2001.

California High-Speed Rail Authority. *Building a High-Speed Train System for California, Final Business Plan*. June 2000.

California Department of Transportation (Caltrans). *California Intercity Rail Capital Program*. February 2001.

Parsons Brinckerhoff. *Los Angeles – Bakersfield High-Speed Ground Transportation Preliminary Engineering Feasibility Study Final Report*. Prepared for California Department of Transportation (Caltrans), December 1994.

Parsons Brinckerhoff. *Task 1.5.2 – High-Speed Train Alignments/Stations Screening Evaluation Methodology*. Prepared for California High-Speed Rail Authority, May 2001.

Parsons Brinckerhoff. *California High-Speed Rail Corridor Evaluation - Environmental Summary.* Prepared for California High-Speed Rail Authority, April 2000.

Parsons Brinckerhoff. *California High-Speed Rail Corridor Evaluation.* Prepared for California High-Speed Rail Authority, December 1999.

Parsons Brinckerhoff. *California High-Speed Rail Corridor Evaluation and Environmental Constraints Analysis.* California Intercity High-Speed Rail Commission, June 1996.

URS Corporation. *Draft LAX Master Plan.* Prepared for the Los Angeles World Airports. November 2000.

Southern California Association of Governments (SCAG). *2001 Regional Transportation Plan Update.* April 2001

Los Angeles County Metropolitan Transportation Authority. *Draft 2001 Long Range Transportation Plan for Los Angeles County.* February 2001

Korve Engineering. *Union Station Alameda District Plan.* Prepared for Catellus Development Corporation and Ratkovich Villanueva Partnership. 1996

San Diego Association of Governments. *2020 Regional Transportation Plan.* April 2000

SWA Group. *Anaheim Stadium Area Master Land Use Plan.* Prepared for the City of Anaheim. February 1999.

6.0 PERSONS AND AGENCIES CONSULTED

The following is a list of people contacted during the preparation of this report.

AGENCIES CONSULTED

Agency Coordination, San Diego Coastal Rail Forum. Meeting attended by Steve Schibuola, James Campbell, Keyvan Pirbazari, IBI Group – Bob Motschall, HDR – Karen Linehan, Katz & Assoc. February 13, 2001

Agency Coordination, Southern California Association of Governments. Meeting attended by Steve Schibuola, IBI Group, February 15, 2001

Agency Coordination, San Diego County Rail transportation agencies: AMTRAK, Caltrans, Metropolitan Transportation Development Board (MTDB), North County Transit District (NCTD), and SANDAG. Coordination of studies, review of ongoing rail projects within the corridor, establishment of No Build conditions for analysis. Meetings attended by Steve Schibuola, Blair Smith, IBI Group – Bob Motschall, HDR, February 27, 2001; March 22, 2001; May 21, 2001.

Agency Coordination, Met with Inland Empire and Bakersfield teams to discuss LA Union Station, Meeting attended by Steve Schibuola, IBI Group, March 2001

P&D Meeting, To discuss station planning. Meeting attended by Steve Schibuola and Keyvan Pirbazari, IBI Group, March 2, 2001

SCRRA/Metrolink, Review alternatives and issues. Meeting attended by Steve Schibuola and Keyvan Pirbazari, IBI Group, March 5, 2001

San Diego Association of Governments, Review alternative and issues. Meeting attended by Steve Schibuola, IBI Group, March 8, 2001

Southern California Association of Governments, Coordination Meeting. Meeting attended by Steve Schibuola, IBI Group, March 15, 2001

MTA, Review alternatives and issues. Meeting attended by Steve Schibuola, IBI Group, March 15, 2001

City of Anaheim, Review alternatives and issues. Meeting attended by Steve Schibuola and Keyvan Pirbazari, IBI Group, March 30, 2001

City of Irvine, Review alternatives and issues. Meeting attended by Steve Schibuola, IBI Group, April 2, 2001

Orange County Transportation Authority, Review alternatives and issues. Meeting attended by Steve Schibuola, IBI Group, April 3, 2001

Gateway Cities Council of Governments, Review alternatives and issues. Meeting attended by Steve Schibuola, IBI Group, April 5, 2001

City of Norwalk, Review alternatives and issues. Meeting attended by Steve Schibuola, IBI Group, April 6 & 20, 2001

California Department of Transportation – District 11, Review alternatives and issues. Meeting attended by Steve Schibuola, IBI Group, April 10, 2001

City of Pico Rivera, Review alternatives and issues. Meeting attended by Steve Schibuola, IBI Group, April 11, 2001

Los Angeles International Airport, Review alternatives and issues. Meeting attended by Steve Schibuola, IBI Group, April 19, 2001

Statewide Transportation and Environmental Agencies, Statewide Scoping Meeting. Meeting attended by Steve Schibuola, IBI Group, April 24, 2001

P&D, Discuss LA Union Station alternatives with Inland Empire and Bakersfield teams. Meeting attended by Steve Schibuola and Keyvan Pirbazari, IBI Group, April 26, 2001

MTA and LA Transportation Agencies, Presentation of issues and alternatives. Meeting attended by Steve Schibuola and Blair Smith, IBI Group, May 1, 2001

Pam Slater, San Diego County Supervisor. Meeting attended by Steve Schibuola, IBI Group, May 3, 2001

Gary Gallegos, California Department of Transportation. Meeting attended by Steve Schibuola, IBI Group, May 3, 2001

San Clemente Chamber of Commerce, Discuss alternatives and issues in Southern Orange County. Meeting attended by Steve Schibuola, IBI Group - Johnny Johnson, Rail Pros, May 16, 2001

Interstate 5 Coalition, Discuss UP Santa Ana Branch and I-5 alignments in SE LA County. Meeting attended by Steve Schibuola and Keyvan Pirbazari, IBI Group, May 18, 2001

7.0 PREPARERS

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Elaine Cartwright Manager of Engineering Projects, Lea + Elliott	M.B.A., San Francisco State University; B.S., Electrical Engineering, Colorado State University • Commuter rail alignment assessment
Sebastian Gladney Transportation Engineer, Lea + Elliott	B.S., Civil Engineering, University of California, Berkeley • Train operations simulation • Cost models

APPENDICES

APPENDIX – A
Travel Time Estimates

A.0 TRAVEL TIME ESTIMATES

This appendix documents the travel time estimates for the alignment options studied in this screening evaluation report. It also documents a preliminary analysis of shared-use operations in the LOSSAN rail corridor.

A.1 TRAVEL TIME ESTIMATES

As described in Section 2.2.1, travel times were estimated for the alignment options using a proprietary train performance simulation model. Travel times were estimated for each alignment option, using representative high-speed and very high-speed technologies.

Table A.1-1 (over the next four pages) summarizes the estimated travel times for local and express service within each alignment option, for each technology. The "express" estimate represents non-stop service from one end of the alignment option to the other, equivalent to semi-express service between Los Angeles and San Diego with stops in Anaheim and Oceanside. The travel times in the tables include two-minutes of dwell at each station, and are unconstrained by other rail traffic. Other traffic would cause congestion.

A.2 SHARED-USE ANALYSIS OF THE LOSSAN CORRIDOR

In dense urban corridors, operation of a proposed HSR system in existing corridors for certain segments may have significant economical, environmental, and/or and constructibility benefits. This study evaluates the feasibility of operating HSR service on existing Metrolink, Coaster, and AMTRAK Pacific Surfliner right-of-way in the heavily congested LOSSAN Corridor. The analysis does not graph freight traffic, but assumes that mid-day and early evenings are reserved for this service. Travel time simulations would be required to specifically account for congestion and delays due to other rail services. The other alignment alternatives have very few shared commuter rails stations. The analysis indicates that there are opportunities to intersperse HSR routes in the alignment during peak periods.

A.2.1 Los Angeles to Oceanside

Characteristics of Metrolink Orange County Line Service

Metrolink provides weekday commuter rail service on nine stations between Oceanside Transit Center and LA Union Station. This commuter service includes two study segments: B - Los Angeles to Central Orange County and C- Central Orange County to Oceanside. Metrolink provides 13 northbound daily trips starting at 4:26 AM and ending at 5:10 PM. There are also 13 southbound trips starting at 5:45 AM and ending at 5:28 PM. Trip time is approximately two hours if all stops are made. Approximate trip distance is 83 miles there is one mid-day run from Orange to Irvine at 1:29 PM, and a return trip starting at 2:05 PM. Headways are from four to ten minutes during peak hours: 4:26 AM to 9:38 AM and 2:50 PM to 6 PM. Most of the existing corridor has a single track, however there are sections of double-track between the Orange County station and the ITC.

Table A.1-1
Summary of Operating "Service Plan" and Travel Times for High-Speed Train Alternatives
Los Angeles-Orange County-San Diego

Segment A – LA Union Station/Southeast LA County to LAX

Alignment Alternative	A1- Interstates 10 and 405				A2 – MTA Harbor Subdivision				A3- Interstates 10, 110 and 105				A4/A5 – Green Line
Technology (Note 1)	VHS		Maglev		VHS		Maglev		VHS		Maglev		LRT or HS
Service Type	Local	Exp.	Local	Exp.	Local	Local	Local	Exp.	Local	Exp.	Local	Exp.	Local
LA Union Station		0		0		0		0		0		**0**	
Norwalk (Segment B station)													0
Paramount (Seg. B)													(Note 2)
Intermediate Stations													•
Imperial/Rosa Parks (Blue Line Connection)													•
LAX Terminal Parking		18.2		17.3		14.4		13.7		17		16.2	35.3

Notes
1. Alignment options A1, A2 and A3 are dedicated corridors, and could be feasible for either very-high-speed (VHS) rail or maglev technology. maglev times have not been estimated for screening, as they would not demonstrate any significant differences between this set of options.
2. The connection to southeast LA County would be in Norwalk or Paramount. The numerical analyses assume Norwalk Metrolink, as it is farthest east.
3. The time includes 22 minutes on the existing Green Line, taken from the current MTA schedule.
4. Maglev trip times have been estimated as a function of VHS Steal-Rail Trains simulated trip times for conceptual planning. These estimates are based on previous modeling results over different alignments of comparable lengths. Maglev trip times are uniformly between 94-96 percent of the VHS Steal-Rail trip times.
5. "Exp." Stands for Express Service

Segment B – LA Union Station to Central Orange County (Anaheim)

Alignment Alternative	B1- LOSSAN Corridor with Upgrades				B2 – Interstate 5				B3 – Pacific Electric and SR-22 via San Pedro Br.				B4 –Santa Ana Branch /I-5 via San Pedro Br.			
Technology (Note 1)	HS (a)		VHS (b)		VHS		Maglev		VHS		Maglev		VHS		Maglev	
Service Type	Local	Exp.	Local	Exp.	Local	Exp.	Local	Exp.	Local	Exp.	Local	Exp.	Local	Exp.	Local	Exp.
LA Union Station	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Southeast LA County																
- Paramount									9.6		9.1					
- Norwalk (Note 2)					11.8		11.2						11.4		10.8	
- Norwalk/Santa Fe Springs LOSSAN	11.7		11.1													
Fullerton	19.4															
Central Orange County																
- Anaheim LOSSAN (Edison Field)	25.4	19.4	21.7	18.3												
- Anaheim/I-5					22.1	19	21	18					20.9	17.1	19.9	16.3
- Garden Grove									19.2	16.4	18.2	15.6				

Notes
1. Travel time estimates are unconstrained, not specifically accounting for delays caused by other rail services. This affects the LOSSAN corridor (Option B1) to the greatest degree.
2. Alignment Option B1 is a shared-use corridor, suitable for high-speed (HS) or very-high-speed (VHS) rail, and correspond to configurations A and B respectively. Options B2, B3 and B4 are dedicated corridors, and could be feasible for either VHS trains or maglev technology.
3. The Norwalk station is on I-5 for alignment Option B2, and on the Union Pacific (UP) Santa Ana line for Option B4.
4. Maglev trip times have been estimated as a function of VHS Steal-Rail Trains simulated trip times for conceptual planning. These estimates are based on previous modeling results over different alignments of comparable lengths. Maglev trip times are uniformly between 94-96 percent of the VHS Steal-Rail trip times.
5. "Exp." Stands for Express Service

Segment C – Central Orange County (Anaheim) to Oceanside

Alignment Alternative	C1- LOSSAN Corridor with Upgrades				C2 – Interstate 5				C3 – SR-73 and I-5, via PE ROW and Santa Ana River				C4 – SR-241 and I-5			
Technology	HS (a)		VHS (b)		VHS		Maglev		VHS		Maglev		VHS		Maglev	
Service Type	Local	Exp.	Local	Exp.	Local	Exp.	Local	Exp.	Local	Exp.	Local	Exp.	Local	Exp.	Local	Exp.
Cen. Orange County																
- Anaheim LOSSAN	0	0	0	0												
- Anaheim/I-5					0	0	0	0					0	0	0	0
- Garden Grove									0	0	0	0				
Santa Ana	6.6															
So. Orange County																
- Irvine LOSSAN	14.7		11.2													
- East Irvine/I-5					9		8.6						8.9		8.5	
- Newport Beach									9.4		8.9					
San Juan Capistrano	23.9															
Northern San Diego County																
- Oceanside TC	43.6	33.9	38.5	32.1												
- Oceanside/I-5					35.9	33.7	34.1	32	37.5	34.5	35.6	32.8	39.8	36.6	37.8	34.8

Notes
1. Travel time estimates are unconstrained, not specifically accounting for delays caused by other rail services. This affects the LOSSAN corridor the most.
2. Alignment Option C1 is a shared-use corridor, suitable for high-speed (HS) or very-high-speed (VHS) rail; these apply to sub-options C1a and C1b respectively. Options C2, C3 and C4 are dedicated corridors, and could be feasible for either VHS trains or maglev technology.
3. Maglev trip times have been estimated as a function of VHS Steal-Rail Trains simulated trip times for conceptual planning. These estimates are based on previous modeling results over different alignments of comparable lengths. Maglev trip times are uniformly between 94-96 percent of the VHS Steal-Rail trip times.
4. "Exp." Stands for Express Service

Segment D – Oceanside to San Diego

Alignment Alternative	D1- LOSSAN Corridor with Upgrades				D2 – Interstate 5			
Technology (Note 1)	HS (a)		VHS (b)		VHS		Maglev	
Service Type	Local	Exp.	Local	Exp.	Local	Exp.	Local	Exp.
Northern San Diego County								
- Oceanside TC	0	0	0	0				
- Oceanside Blvd/I-5					0	0	0	0
Central San Diego County								
- Solana Beach LOSSAN	10.8		10					
- Solana Beach I-5					10.8		10.3	
- University City	19.4							
San Diego								
- Airport Intermodal					24.3	21.4	23	20.3
- Santa Fe Depot (Downtown)	30.9	24.5	27.1	23.2				

Notes
1. Travel time estimates are unconstrained, not specifically accounting for delays caused by other rail services. This affects the LOSSAN corridor the most.
2. Alignment Option D1 is a shared-use corridor, suitable for high-speed (HS) or very-high-speed (VHS) rail; these apply to sub-options D1a and D1b respectively. Option D2 is a dedicated corridor, and could be feasible for either VHS trains or maglev technology.
3. Maglev trip times have been estimated as a function of VHS Steal-Rail Trains simulated trip times for conceptual planning. These estimates are based on previous modeling results over different alignments of comparable lengths. Maglev trip times are uniformly between 94-96 percent of the VHS Steal-Rail trip times.
4. "Exp." Stands for Express Service

Characteristics of Amtrak Pacific Surfliner Service

Amtrak provides 10 weekday trips between Oceanside and Los Angeles Union station starting at 6AM and ending at 12:30 PM. These trips originate in either San Diego or Los Angeles. However, only two of the ten trips occur within the peak commute hours. Trip time between Oceanside to Los Angeles is two hours if all stations are served. On most trips the San Juan Capistrano stop is omitted. Table A.2-1 provides an overview of the shared stations between Metrolink, Amtrak and the LOSSAN corridor segments B1 and C1:

Table A.2-1
Summary of Commuter Rail and High-Speed Train Stations, Oceanside to Los Angeles

Station	Metrolink	Amtrak	LOSSAN B1 - Local HS	LOSSAN C1 – Local HS
Oceanside Transit Center	X	X		X
San Clemente	X	X (special stop)		
San Juan Capistrano	X	X		X
Irvine Transit Center	X	X		X
Santa Ana	X	X		X
Orange	X			
Anaheim	X	X	X	X
Fullerton	X	X	X	
Norwalk/Santa Fe Springs	X		X	
Commerce	X			
LA Union Station	X	X	X	

A.2.2 Inbound (Oceanside Transit Center To LA Union Station)

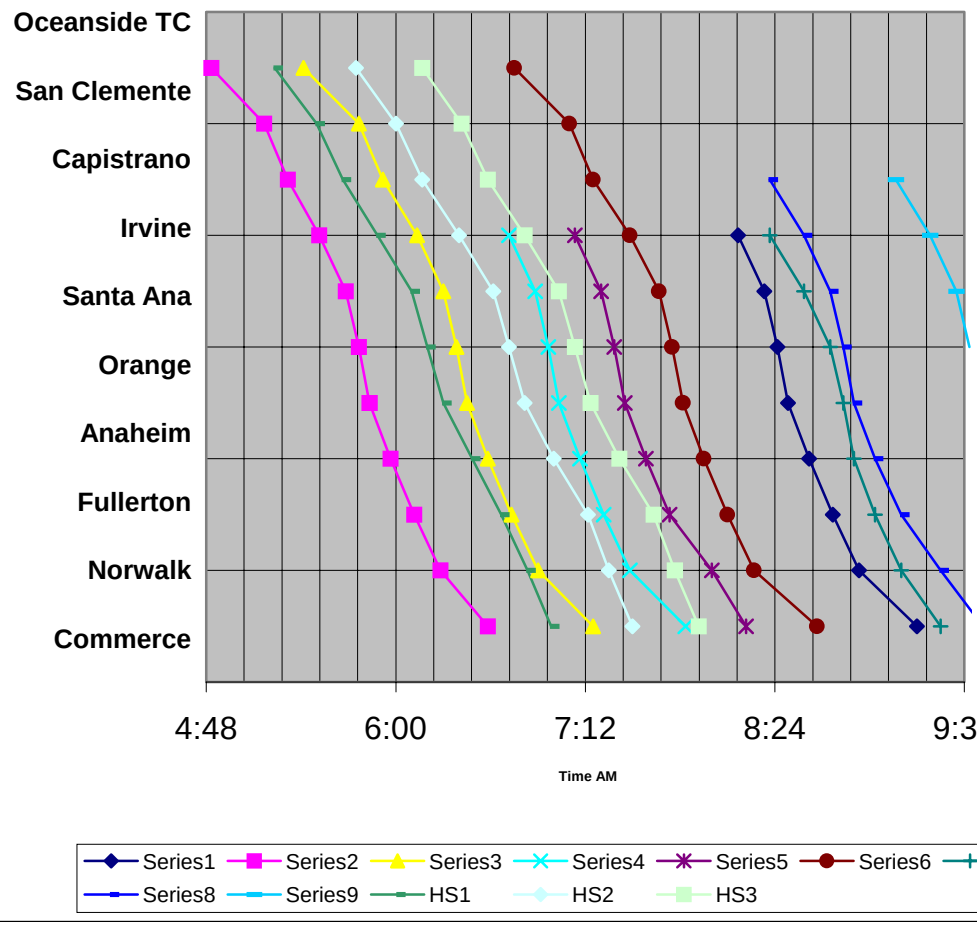
Table A.2-2 shows three potential high-speed inbound trips, using simulated trip times. A longer five-minute dwell time has been assumed in this analysis to account for delay caused by other rail services. The longer dwell time at stations allows for rail traffic to pass.

Table A.2-2
Simulated Trip times and Schedules for Inbound Theoretical High-Speed Service

Station	Travel time Between Stations		Theoretical Schedule Times		
	Simulated	+5 min. Stop	HS1	HS2	HS3
Oceanside Transit Center	↓	↓	5:14	5:45	6:10
San Clemente					
San Juan Capistrano	19.7	25	5:39	6:10	6:35
Irvine Transit Center	9.2	14	5:53	6:24	6:49
Santa Ana	8.1	13	6:06	6:37	7:02
Orange					
Anaheim	6.6	12	6:18	6:49	7:14
Fullerton	6	11	6:29	7:00	7:25
Norwalk/Santa Fe Springs	7.7	13	6:42	7:13	7:38
Commerce					
LA Union Station	11.7	17	6:59	7:30	7:55

Figure A.2.1 graphs inbound service routes for Metrolink (Series 1-9) and Amtrak (AM1, AM2, and AM3) between 4:48 AM and 9:36 AM, along with three theoretical HS trips (HS1, HS2, and HS3) calculated in Table A.2-2.

Figure A.2-1 - Inbound HS Rail Trips among Metrolink and Amtrak Rail Service



The rail traffic is the heaviest along this segment during this time frame. Nine inbound Metrolink routes are shown starting at 4:50 through 8:22 AM, and three Amtrak routes are shown. (Only one of these routes, AM1 starting from Oceanside at 7:00 AM and arriving at LA Union Station at 8:50 AM, fits within the peak commute time frame.) Three theoretical high-speed routes, (HS1, HS2, and HS3), are shown interspersed within the commute service time frames. The shortest headway is five minutes at Norwalk where HS1 arrives at 6:30 AM and the Metrolink commuter train arrives at 6:35 AM. The high-speed service routes are only theoretical, but demonstrate the feasibility of sharing the track during the most congested time of day. Various parameters, including safety regulations, train control, station design capacity, operating practices and freight use must be carefully considered in a shared-use environment.

A.2.3 Outbound (LA Union Station to Oceanside Transit Center)

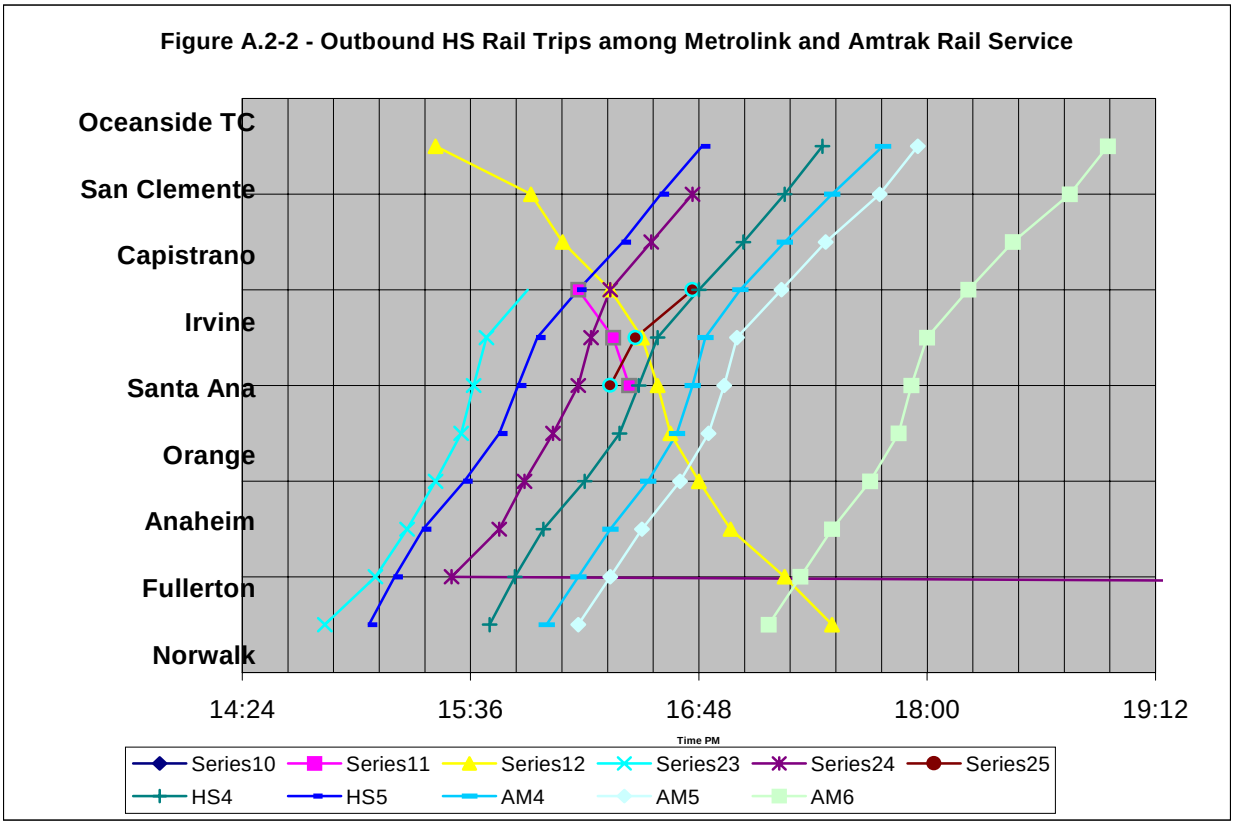
Table A.2-3 shows two potential high-speed outbound trips:

Table A.2-3
Simulated Trip times and Schedules for Outbound Theoretical High-Speed Service

Station	Travel time Between Stations		Theoretical Schedule Times	
	Simulated	+5 min. Stop	HS4	HS5
LA Union Station	↓	↓	15:42	15:04
Commerce				
Norwalk/Santa Fe Springs	12	17	15:59	15:21
Fullerton	8	13	16:12	15:34
Anaheim	6	11	16:23	15:45
Orange				
Santa Ana	7	12	16:35	15:57
Irvine Transit Center	8	13	16:48	16:10
San Juan Capistrano	9	14	17:02	16:24
San Clemente				
Oceanside Transit Center	20	25	17:27	16:49

Figure A.2-2 graphs outbound service routes for Metrolink (Series 1-9) and Amtrak (AM1, AM2, and AM3) between 4:48 AM and 9:36 AM, along with two theoretical HS trips (HS5 and HS4) calculated in Table A.2-3.

Figure A.2-2 - Outbound HS Rail Trips among Metrolink and Amtrak Rail Service



Characteristics of Coaster Service

The North County Transit District's "Coaster" provides weekday commuter rail service on six stations between San Diego and Oceanside Transit Center. This commuter service includes only one study segments, D: Oceanside to San Diego. Coaster provides 9 northbound daily trips starting at 6:33 AM and ending at 6:24 PM. There are also 9 southbound trips starting at 5:23 AM and ending at 5:28 PM. Trip time is approximately one hour, and approximate trip distance is 48 miles. The single-track service is tightly coordinated during peak commute hours (5:30 AM to 8:30 AM, and 3:30 PM to 7L30 PM). Trains frequently cross paths at the Old Town, Sorrento Valley, and Carlsbad Poinsettia stations. Table A.2-4 provides an overview of the shared transit stations between Coaster, Amtrak and the LOSSAN corridor Option D1:

Table A.2-4
Summary of Common Commuter Rail Service Stations with High-Speed Train Stations

Station	Coaster	Amtrak	LOSSAN D1 - Local HS
Oceanside Transit Center	X	X	X
Carlsbad Village	X		
Carlsbad Poinsettia	X		
Encinitas	X		
Solana Beach	X	X	X
Sorrento Valley	X		
Old Town	X		
San Diego	X	X	X

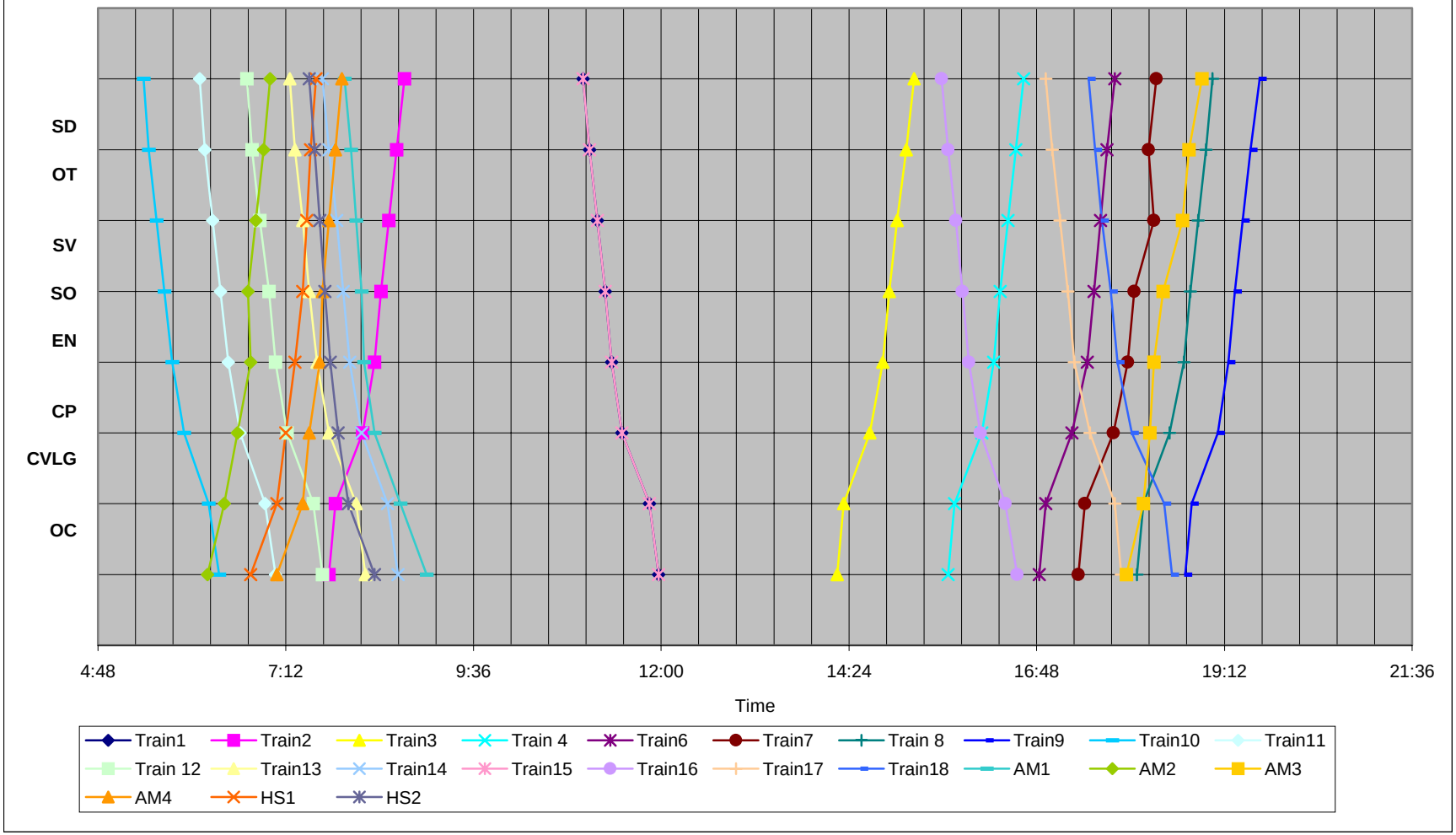
A.2.4 San Diego to Oceanside Transit Center

Table A.2-5 shows potential High-Speed trips, using simulated trip times:

Table A.2-5
Simulated Trip times and Schedules for Theoretical High-Speed Service
San Diego to Southern Orange County - Option D1

Station	Travel time Between Stations		Theoretical Schedule Times	
	Simulated	+5 min. Stop Time	HS1	HS2
Oceanside Transit Center			7:30	7:30
Carlsbad Village			↑	↓
Carlsbad Poinsettia			↑	↓
Encinitas			↑	↓
Solana Beach	10.8	16	7:14	7:46
Sorrento Valley			↑	↓
Old Town	8.6	14	7:00	8:00
San Diego	15.1	20	6:40	8:20

Figure A-2.3 - HS Trips among Coaster and Amtrak



APPENDIX – B

Heavy Rail Studies

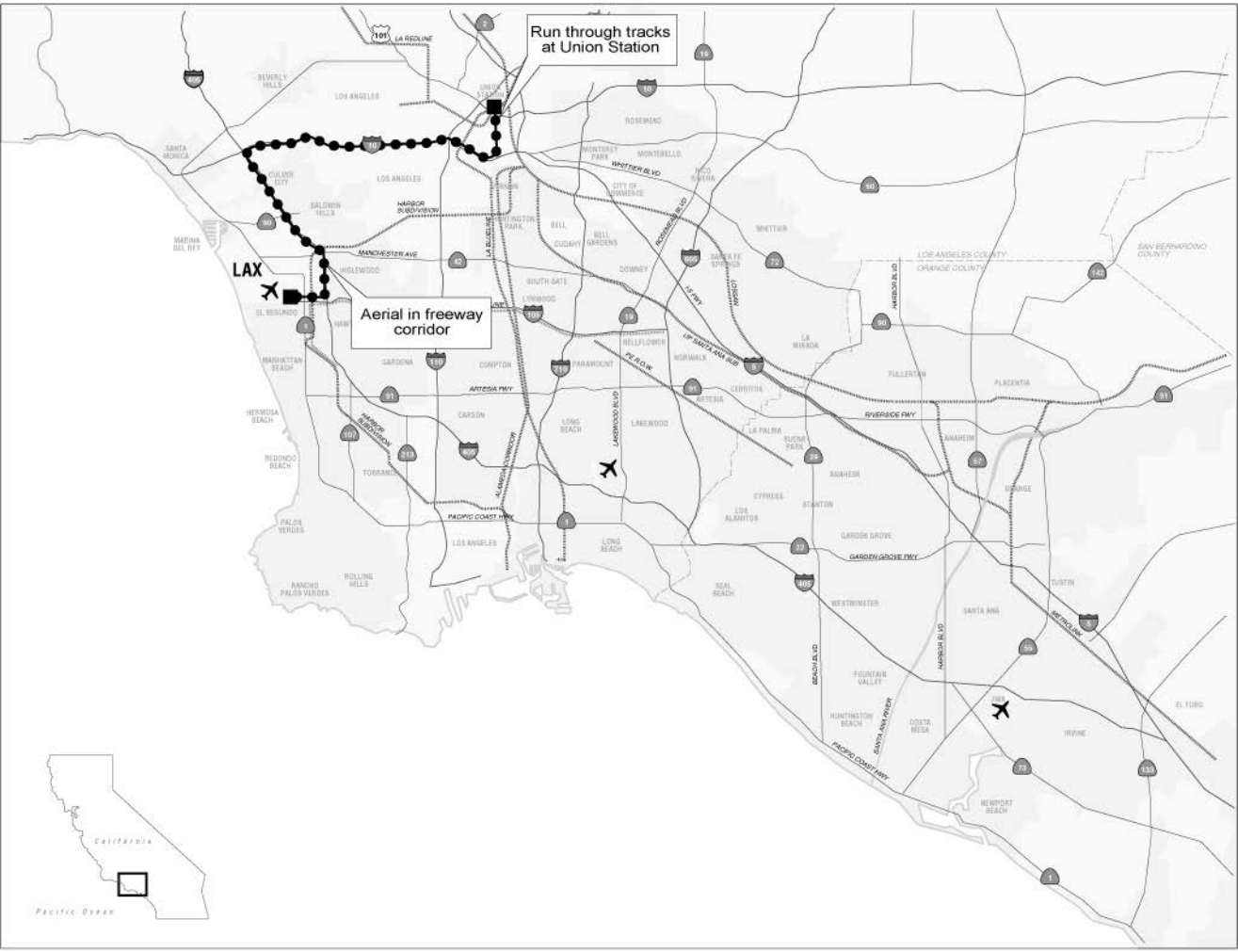
in Coastal San Diego County

HEAVY RAIL STUDIES IN COASTAL SAN DIEGO COUNTY (1)

	Los Angeles to San Diego via Orange County Program Environmental Study	California Passenger Rail System 20-Year Plan: Southern California	California Intercity Rail Capital Program	Coastal Double Track Implementation Policy
Lead Agency	California High-Speed Rail Authority (CHSRA), a state agency authorized to develop and implement an intercity high-speed train system that is fully coordinated with other public transportation services.	Amtrak, operator of the nation's intercity passenger rail system.	Caltrans.	North County Transit District (NCTD), operators of public transportation services in North San Diego County, including the Coaster Commuter rail service.
Agency Vision	• Study the feasibility of implementing the fastest, highest-quality rail system as part of a statewide High-Speed Train System.	• Study improvements to allow existing trains to run faster and more frequently - every hour, at up to 125 mph.	• Identify capital projects that benefit intercity rail passenger service in California.	• Implement near-term right-of-way improvements and define a plan for further implementation of double-tracking.
Key Study Differences	• Seamless statewide network • Top Speed: 125 mph or higher (speeds restricted in urban areas) • Studying LOSSAN and other corridors	• Regional corridors feeding nationwide network • Speed: up to 125 mph • Studying only LOSSAN corridor		• Regional commuter, intercity & freight railroad • Speed: up to 110 mph • Studying LOSSAN and some bypass alignments
Agency's Sphere of Influence	State of California 	U.S.A. 	State of California 	Northern & Coastal San Diego County 
Common Element	A high-speed passenger train system between Los Angeles Union Station and San Diego through Orange County. 			Passenger trains in Coastal San Diego County 
Alignments being studied (San Diego County)	• LOSSAN Corridor • I-5 • I-5 (Inland Empire Corridor) • Are there others we should study?	• LOSSAN Corridor only • Del Mar Bluffs Alternatives • Miramar Hill Tunnel		• LOSSAN Corridor, south of Orange County line. • Del Mar Bluffs Alternatives
Station locations under consideration (San Diego County)	Major gateway stations in: • North San Diego County (Oceanside) • North San Diego (University Towne Centre) • Downtown San Diego (Airport or Depot) • Are there others we should study?	Minor improvements to all existing Amtrak stations		Improvements to existing Coaster stations + new station at Nobel Drive.
Technologies under consideration	Steel Wheel/Steel Rail High-Speed Rail, 125 mph and higher *  Maglev, 200 mph and higher *  * *Reduced speeds in urban areas.*	Steel Wheel/Steel Conventional Rail, up to 125 mph 		Steel Wheel/Steel Conventional Rail, up to 110 mph 
Project Status	Business Plan completed. Draft Program Environmental Impact Report (PEIR) underway, and expected to be released in early 2003.	Twenty-year plan released in early 2001. Subject to funding, immediate implementation for short-term improvements, and environmental studies for long-term improvements could begin in mid-2001.	Program is updated on an ongoing basis.	Draft Policy issued to NCTD Board in October, 2000. Circulating for public comment, and may be adopted in Spring, 2001.
Funding Sources	• State of California	• Intercity Rail Program • Inter-regional Transportation Improvement Program • Federal Transit/Railroad Administrations • Bond 116 • Amtrak • BNSF • Transnet		• Transnet • Regional Transportation Improvement Program (RTIP) • Federal Transit Administration
Why Four Planning Efforts	Although they share a common segment along the LOSSAN corridor through Los Angeles, Orange and San Diego Counties, the projects are responding to different mandates. The Authority intends to build on Amtrak's and NCTD's work, and explore whether higher levels of improvements, including a fully grade-separated system capable of traveling at higher speeds along portions of the corridor, are feasible and desirable. Each agency is continuing to fulfill its mandate by doing all required environmental review, including consulting with local agencies and the public on questions appropriate to each system. **In the context of a statewide rail system, we are seeking your input on alignments, station locations and key issues of concern.**			

Notes: **(1)** Studies listed do not include the San Diego Trolley, light rail system. Planning for the Trolley is lead by San Diego MTDB.
(2) LOSSAN: LOS ANGELES - SAN DIEGO Rail Corridor, currently served by Coaster, Amtrak, and Metrolink trains.

APPENDIX – C
Alignment Options



June 27, 2001

California High-Speed Train Program EIR/EIS

4 0 4 Miles

4 0 4 Kilometers

Legend

- At-grade
- Aerial
- Tunnel/trench
- Station

Figure C.1.1
Alignment Option A1

June 27, 2001

California High-Speed Train Program EIR/EIS

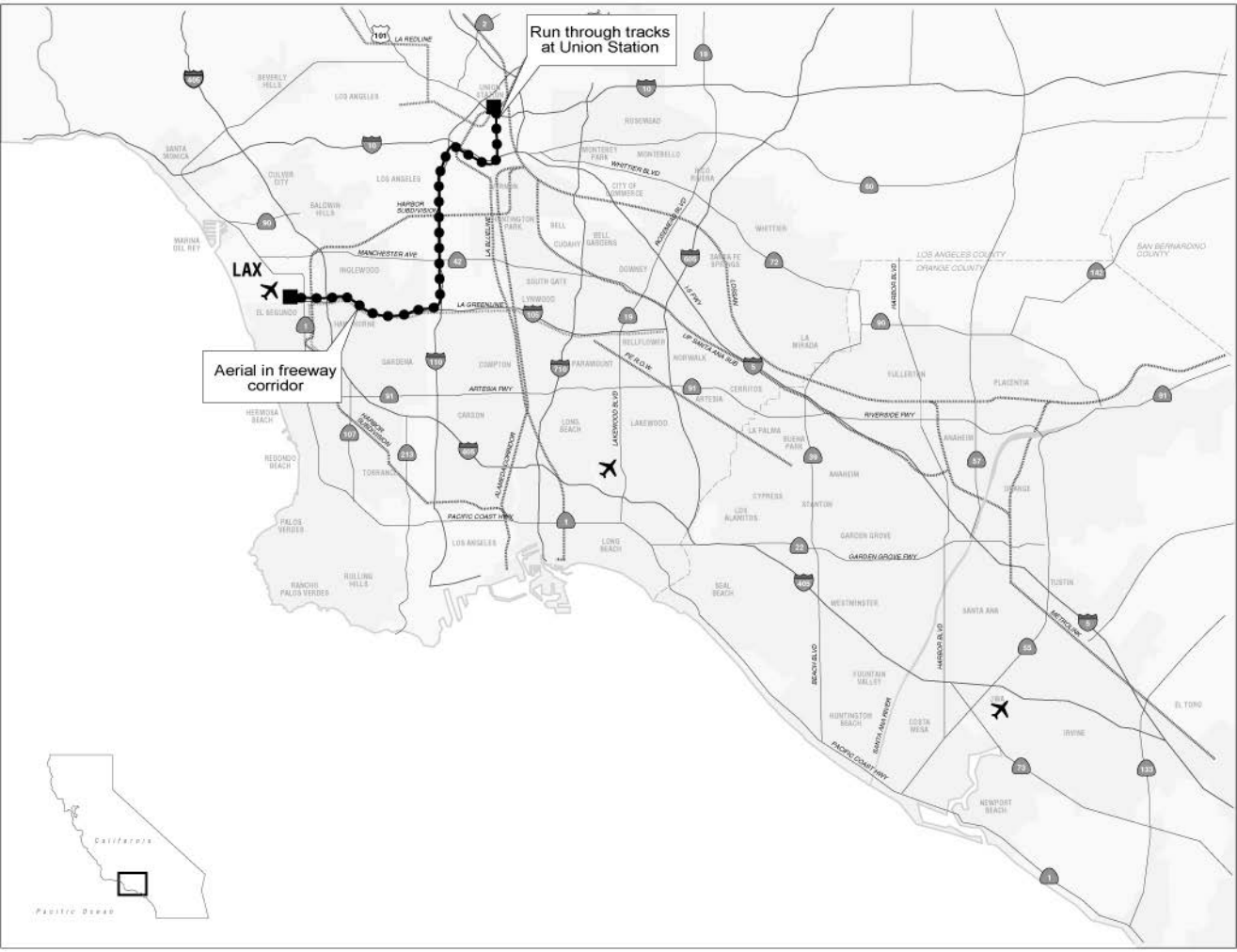
4 0 4 Miles

4 0 4 Kilometers

Legend

- At-grade
- Aerial
- Tunnel/trench
- Station

Figure C.1.2
Alignment Option A2



June 27, 2001

California High-Speed Train Program EIR/EIS

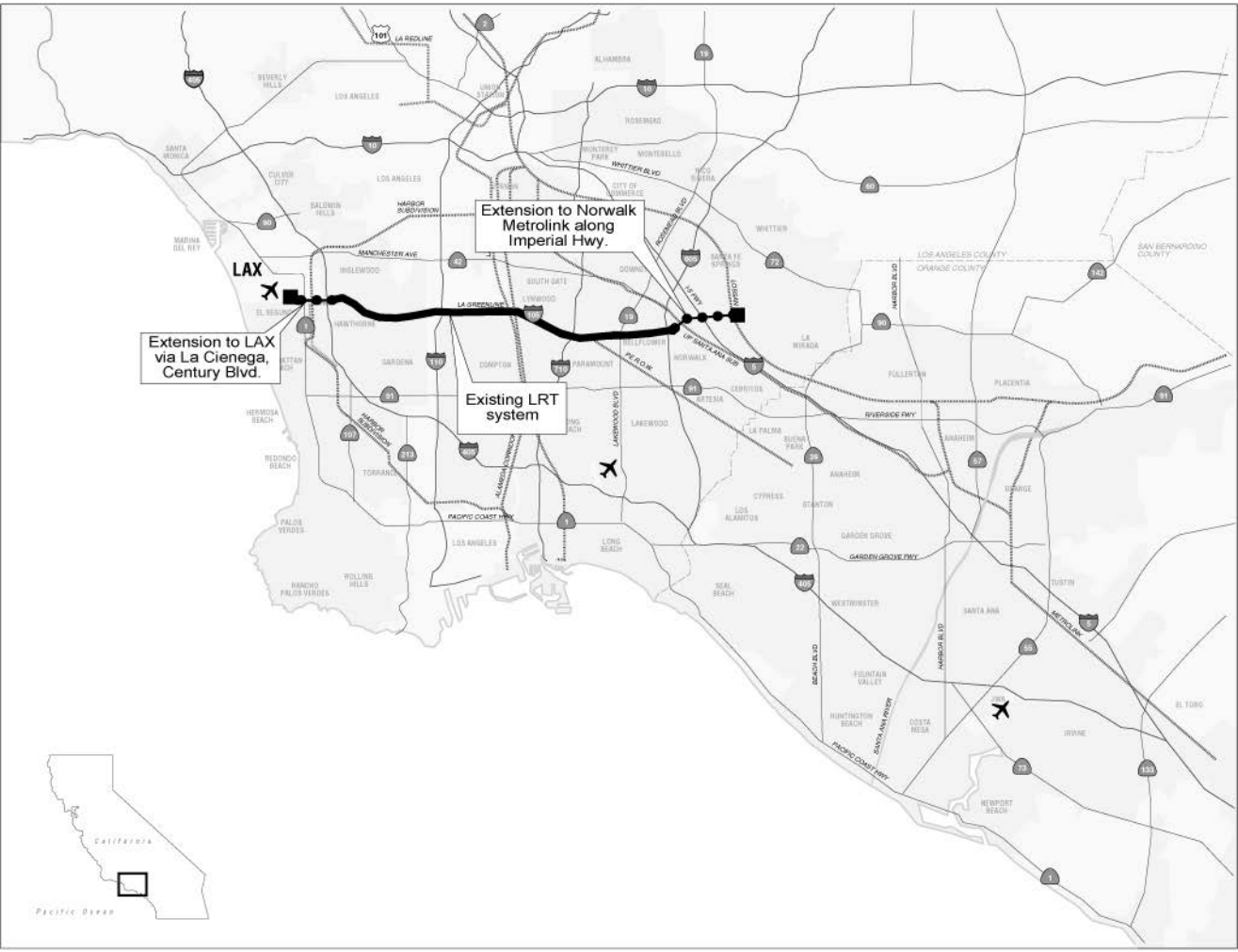
4 0 4 Miles

4 0 4 Kilometers

Legend

- At-grade
- Aerial
- Tunnel/trench
- Station

Figure C.1.3
Alignment Option A3



June 27, 2001

California High-Speed Train Program EIR/EIS

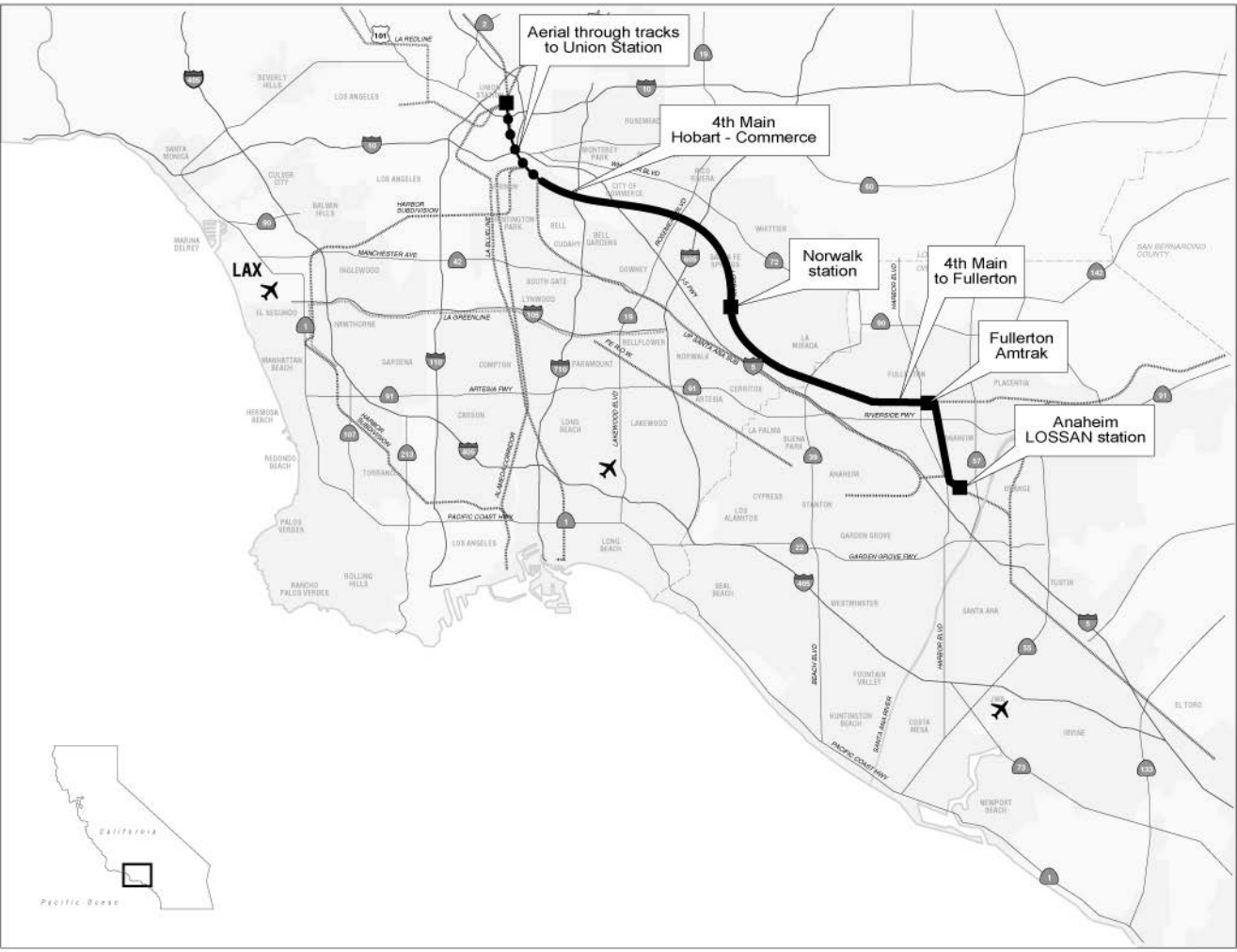
4 0 4 Miles

4 0 4 Kilometers

Legend

- At-grade
- Aerial
- Tunnel/trench
- Station

Figure C.1.4
Alignment Option A5



June 27, 2001 *California High-Speed Train Program EIR/EIS*

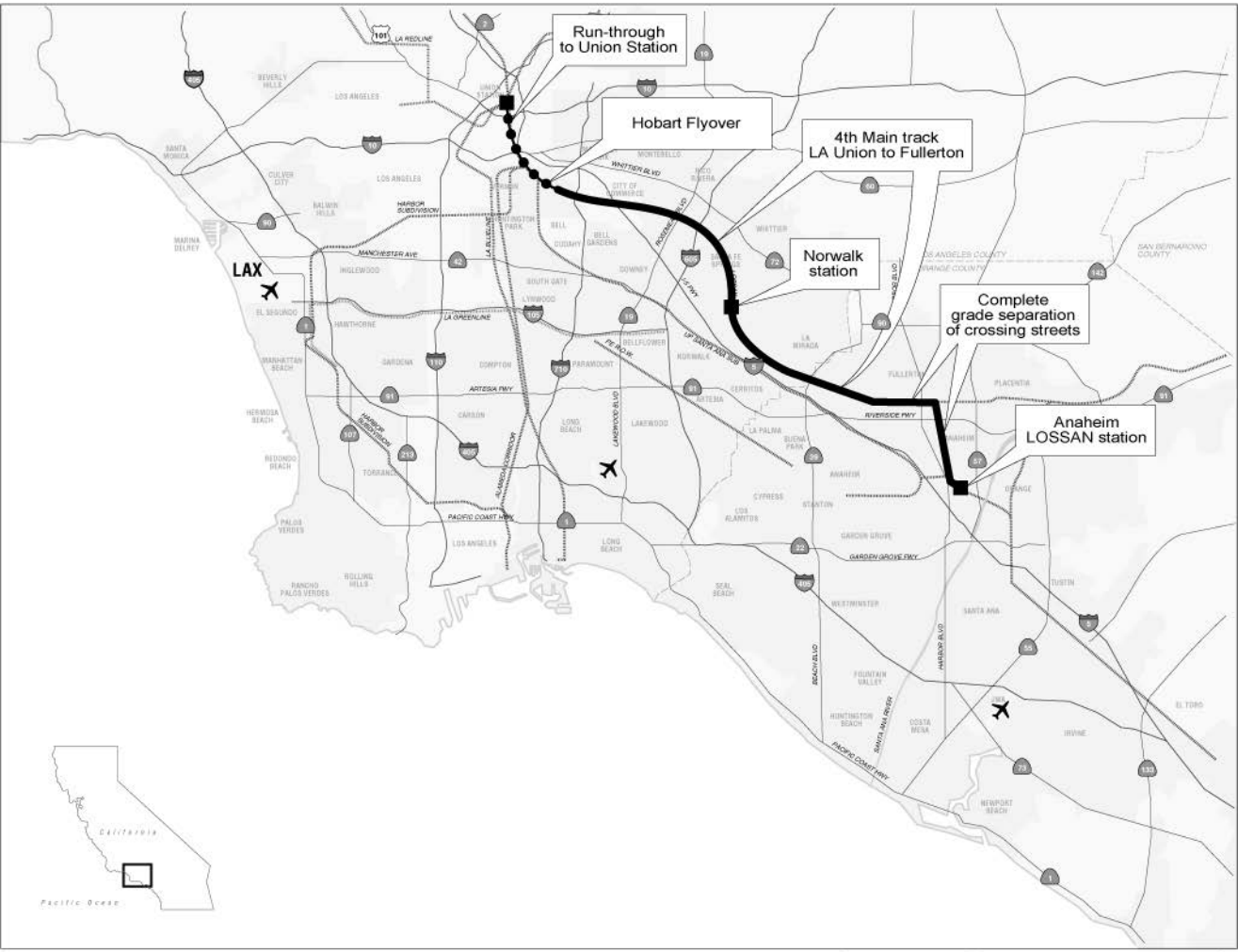
4 0 4 Miles

4 0 4 Kilometers

Legend

- At-grade
- Aerial
- Tunnel/trench
- Station

Figure C.2.1
Alignment Option B1a



June 27, 2001 *California High-Speed Train Program EIR/EIS*

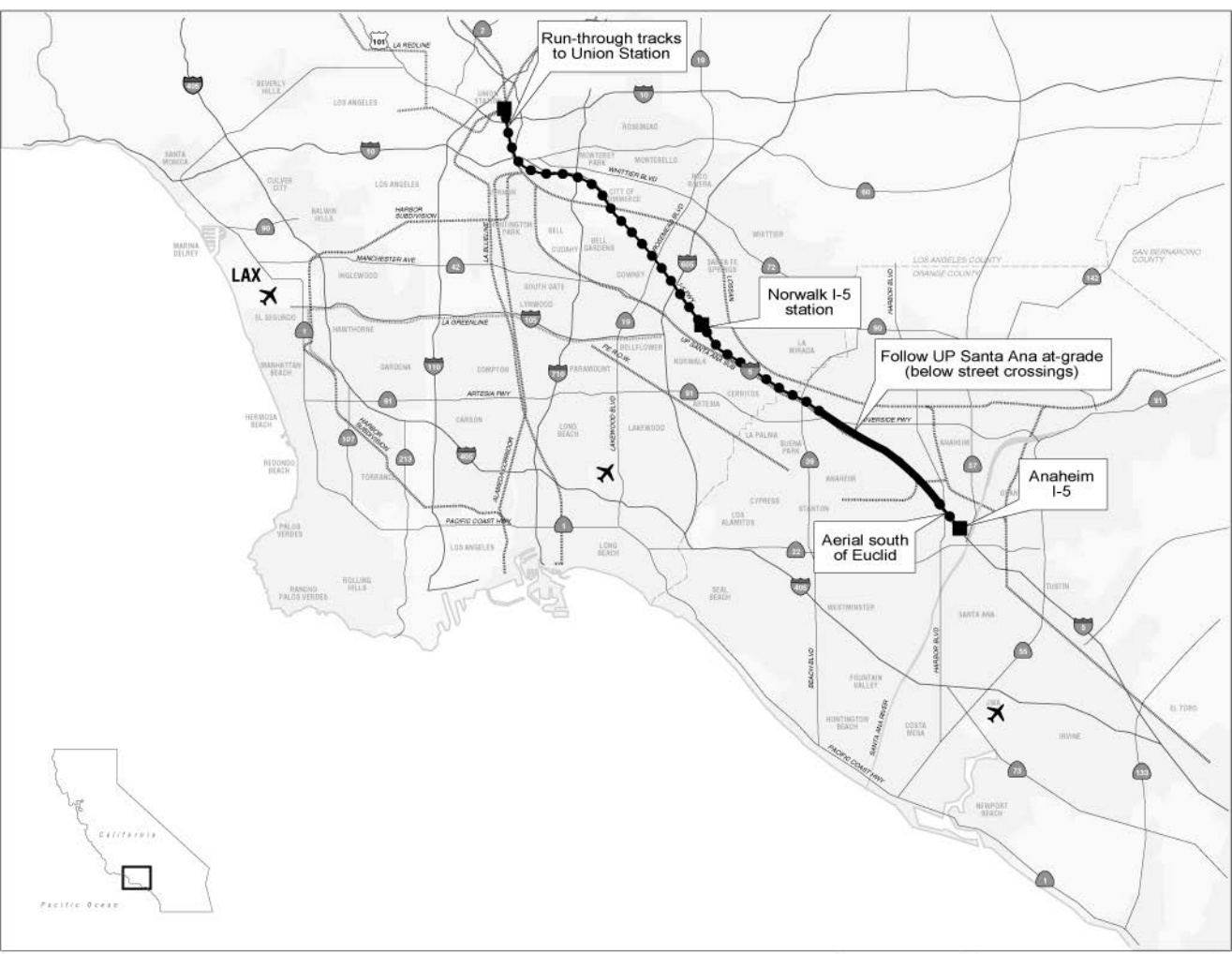
4 0 4 Miles

4 0 4 Kilometers

Legend

- At-grade
- Aerial
- Tunnel/trench
- Station

Figure C.2.2
Alignment Option B1b



June 27, 2001 *California High-Speed Train Program EIR/EIS*

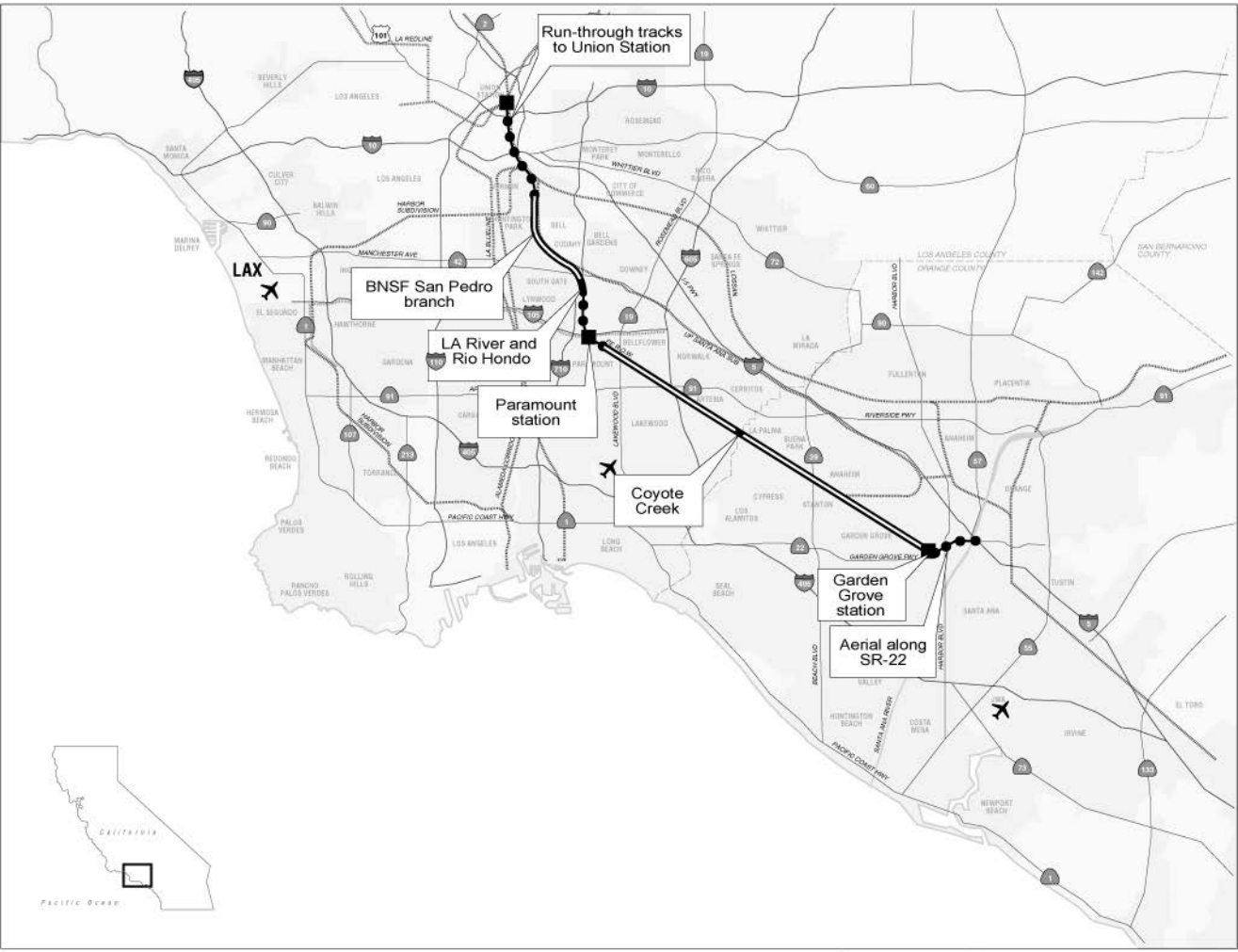
4 0 4 Miles

4 0 4 Kilometers

Legend

- At-grade
- Aerial
- Tunnel/trench
- Station

Figure C.2.3
Alignment Option B2



June 27, 2001 *California High-Speed Train Program EIR/EIS*

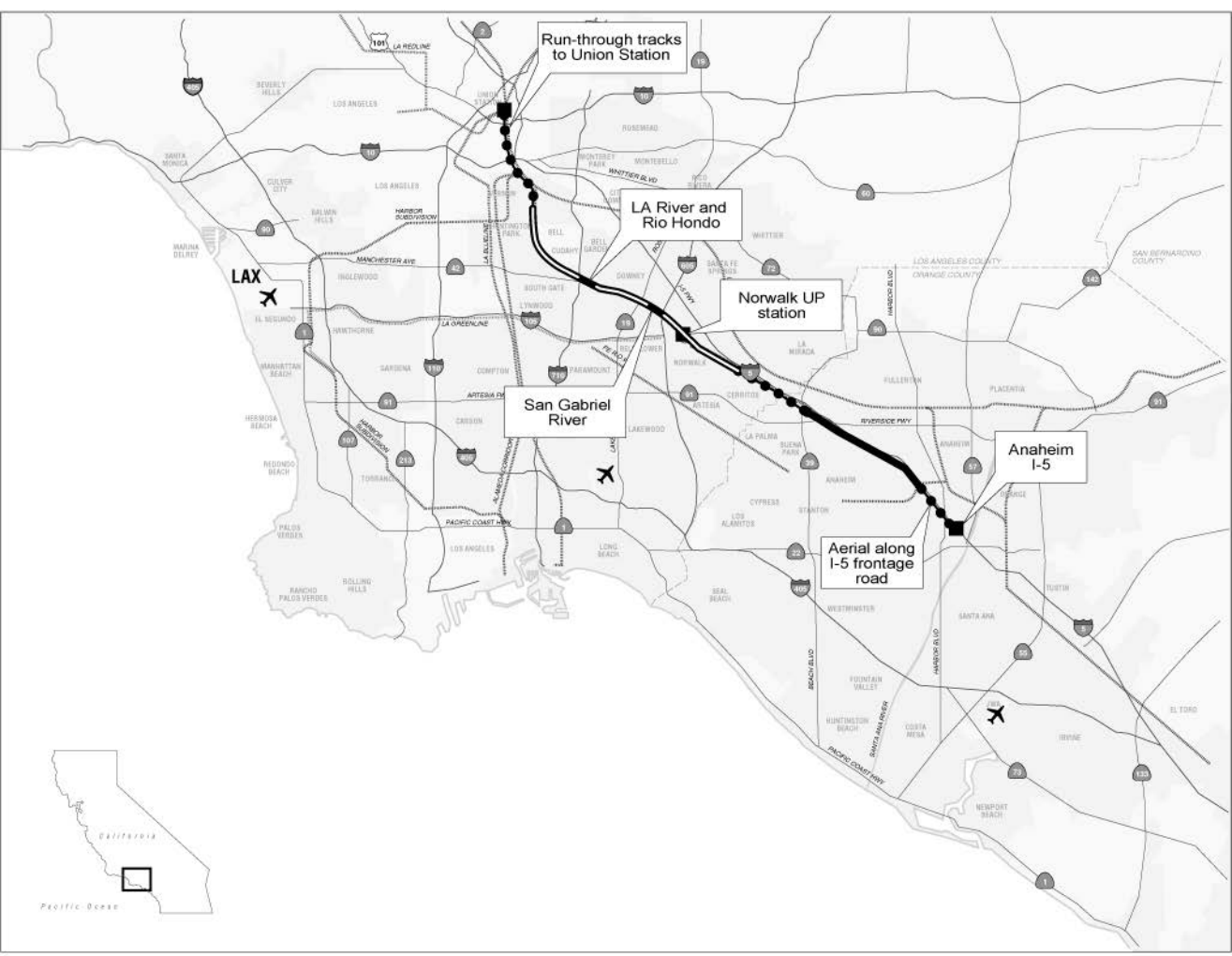
4 0 4 Miles

4 0 4 Kilometers

Legend

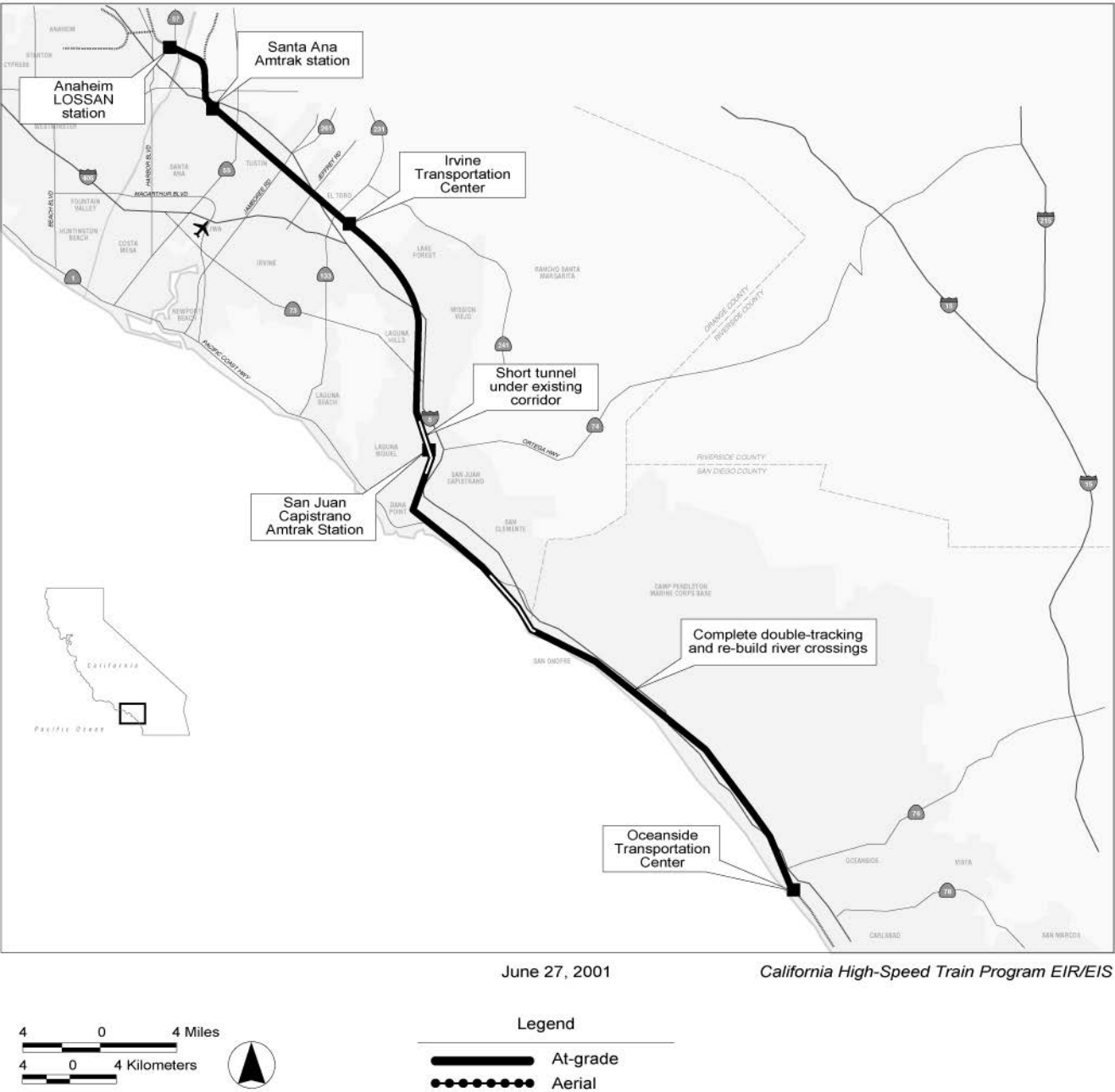
- At-grade
- Aerial
- Tunnel/trench
- Station

Figure C.2.4
Alignment Option B3



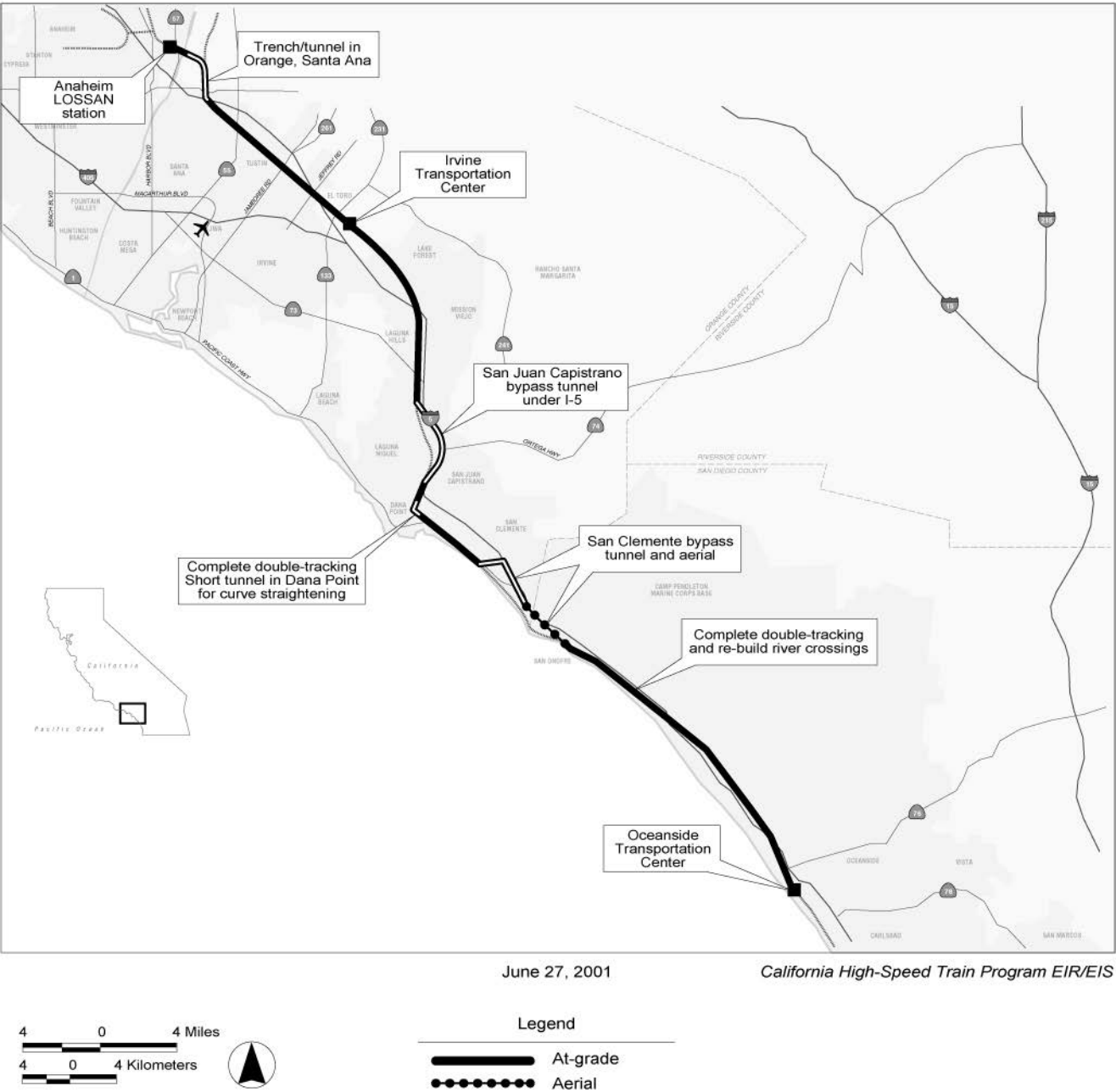
June 27, 2001 *California High-Speed Train Program EIR/EIS*

Figure C.2.5
Alignment Option B4



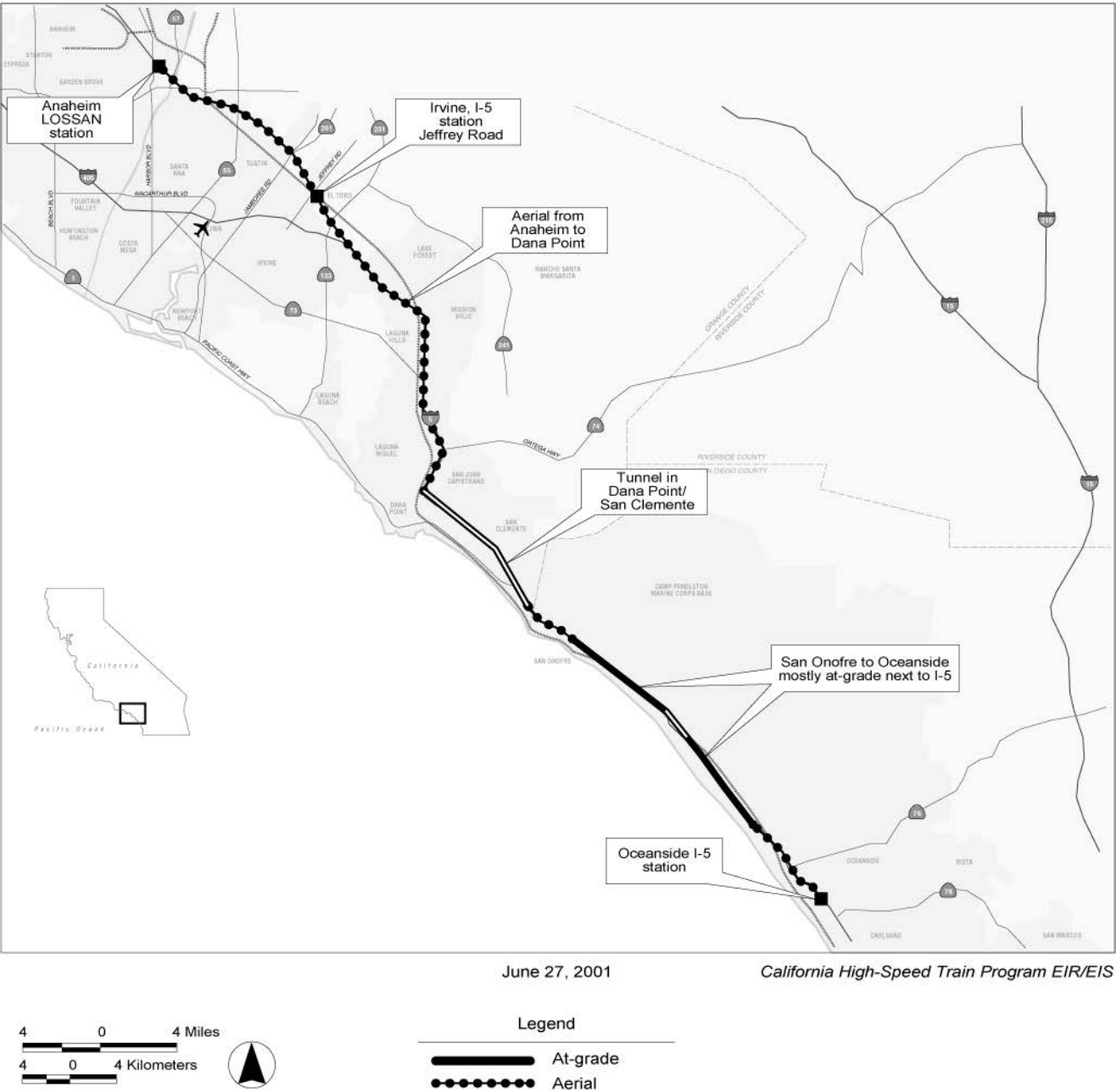
June 27, 2001 *California High-Speed Train Program EIR/EIS*

Figure C.3.1
Alignment Option C1a



June 27, 2001 *California High-Speed Train Program EIR/EIS*

Figure C.3.2
Alignment Option C1b



June 27, 2001 *California High-Speed Train Program EIR/EIS*

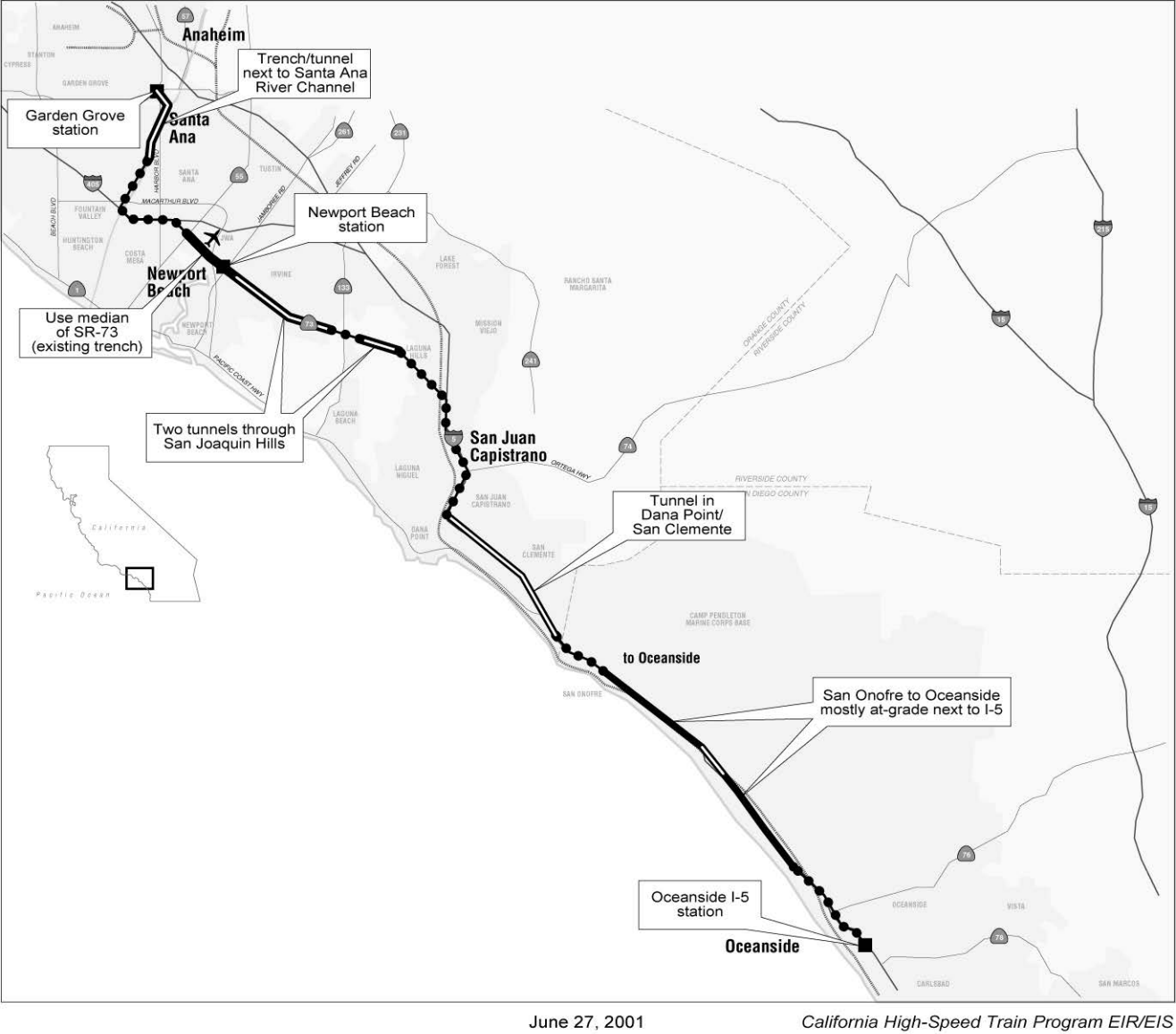
4 0 4 Miles

4 0 4 Kilometers

Legend

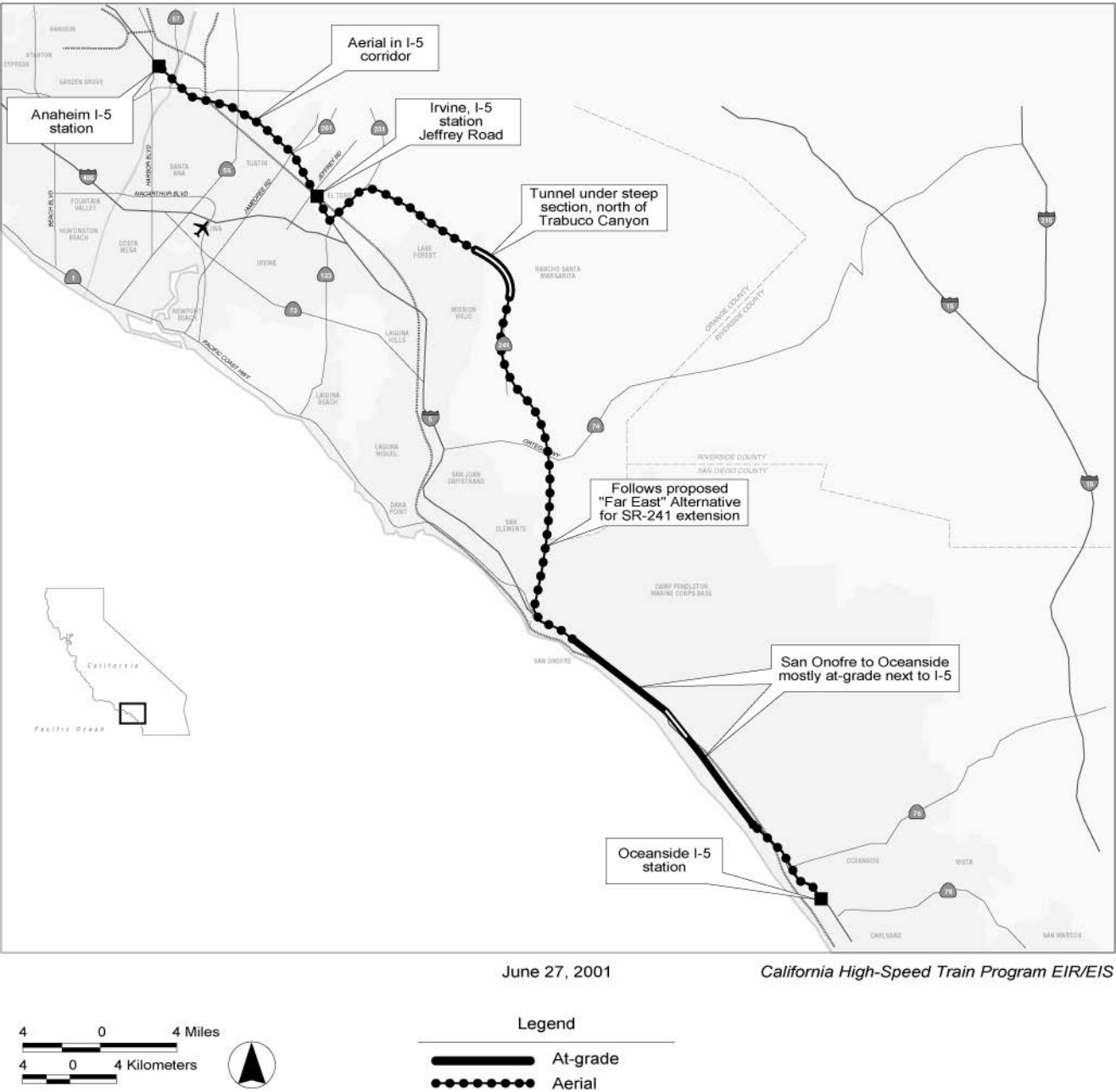
- At-grade
- Aerial
- Tunnel/trench
- Station

Figure C.3.3
Alignment Option C2



June 27, 2001 *California High-Speed Train Program EIR/EIS*

Figure C.3.4
Alignment Option C3



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4 0 4 Miles

4 0 4 Kilometers

Legend

- At-grade
- Aerial
- Tunnel/trench
- Station

Figure C.3.5
Alignment Option C4

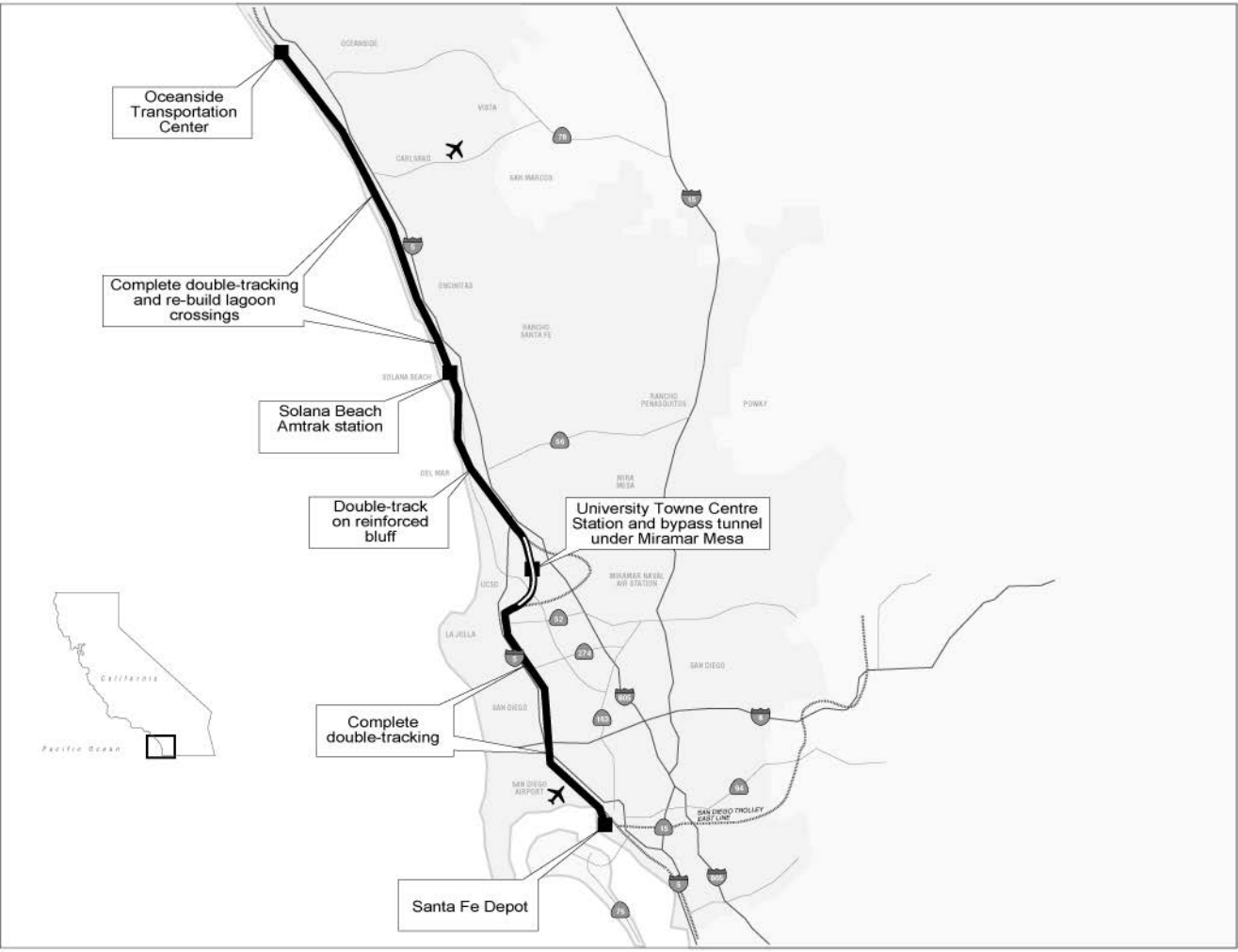

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Figure C.4.1
Alignment Option D1a

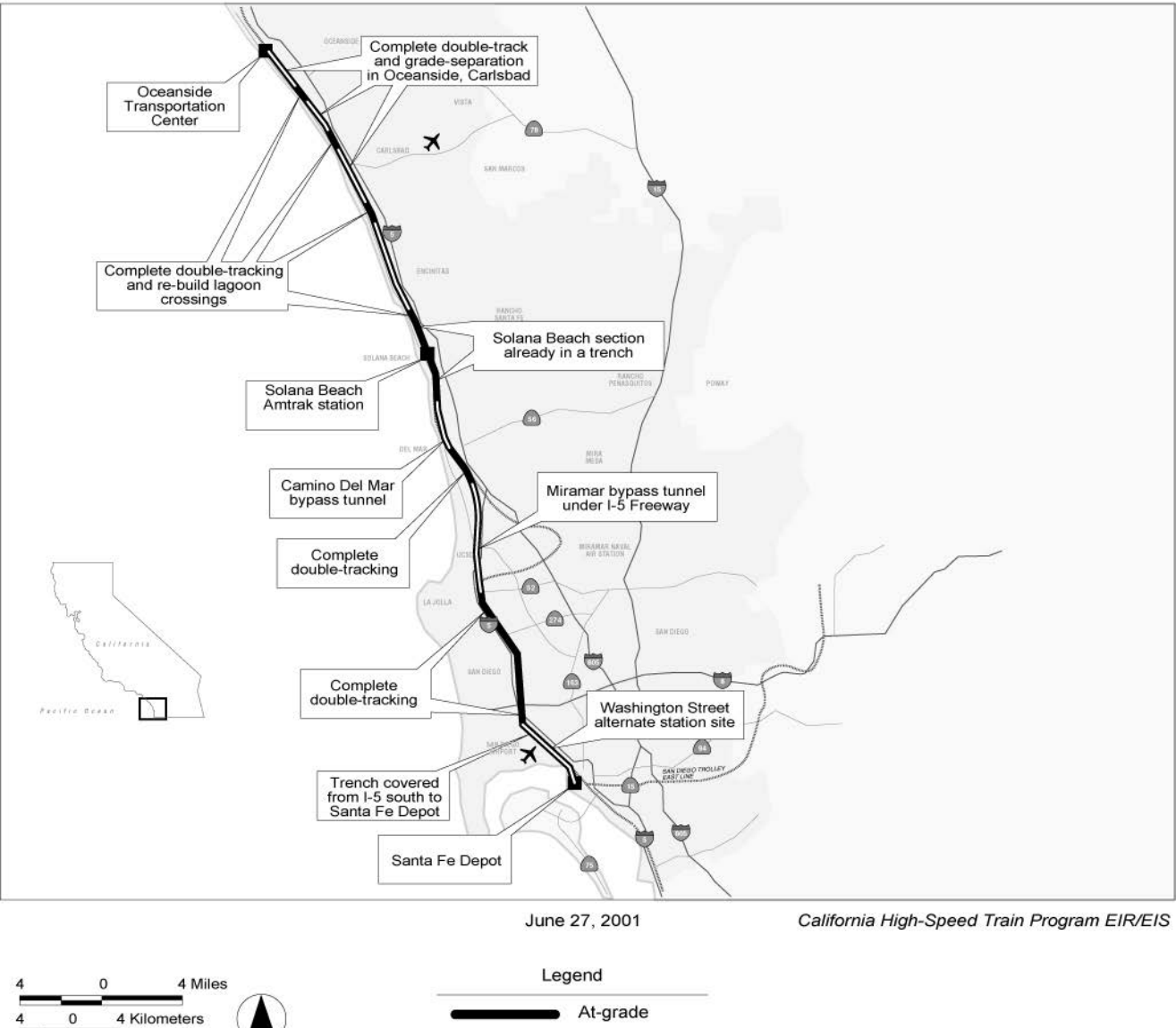

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Figure C.4.2
Alignment Option D1b

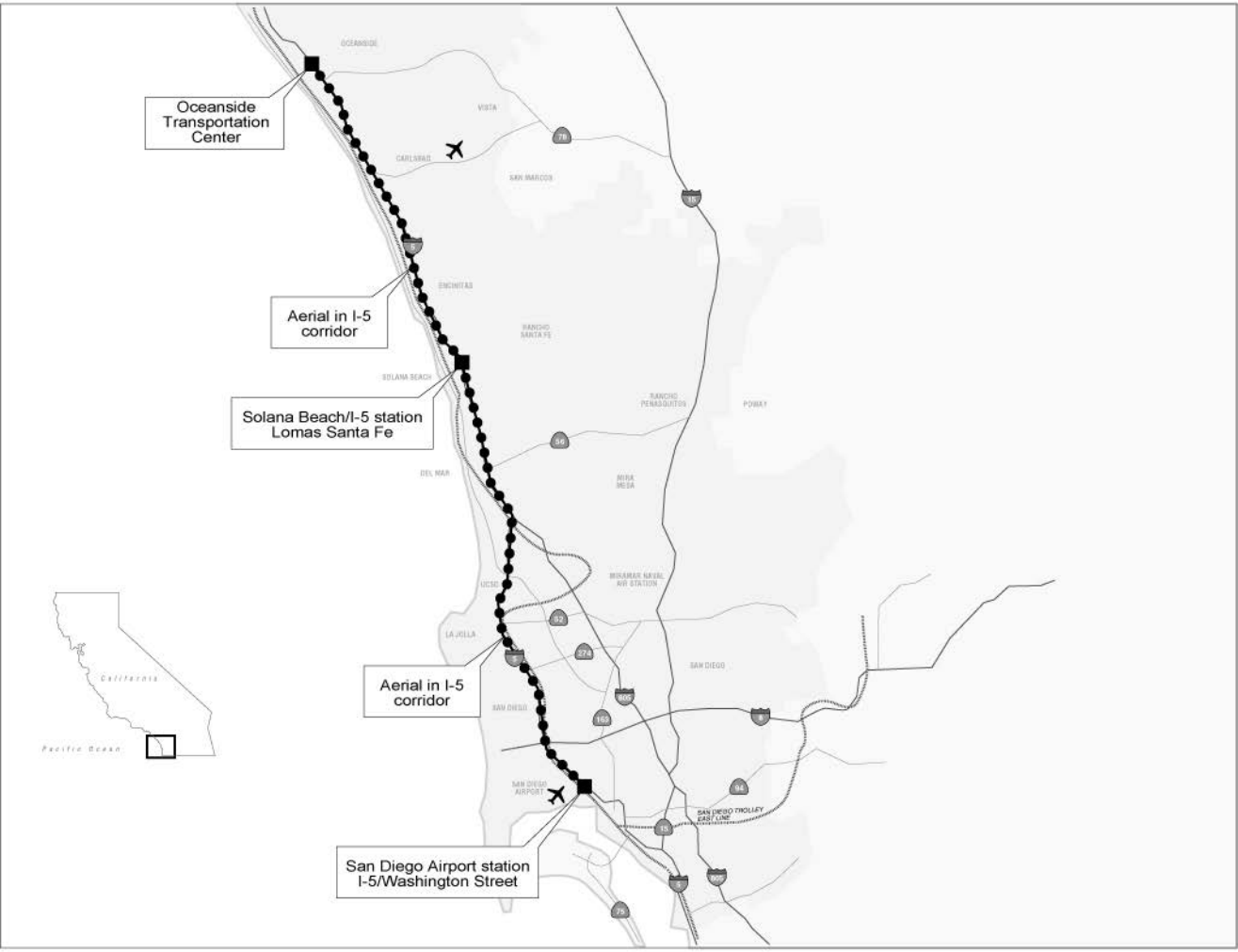

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Figure C.4.3
Alignment Option D2